73 AMATEUR RADIO

International Edition

JULY 1989
ISSUE #346
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Microwave/Video Issue!

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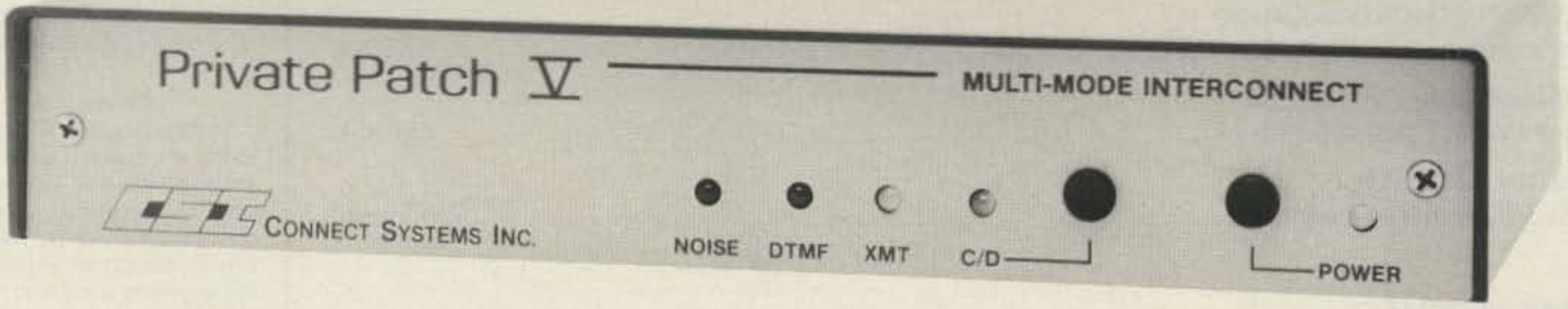

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It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

Cover: Debra Davis KA7FPL operating the AEA 430 70 cm fast-scan transceiver at Puget Sound.

Cover by Marilyn Moran

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Welcome, Newcomers!

What's "Hot" About Microwaves

Microwaves first awed many of us (and made some of us very suspicious) with their ability to brew up a piping hot cup of coffee in 30 seconds, or cook a meal in three minutes. Now we hear more about communications associated with microwaves. Telephone companies routinely use microwave relays, and many television studios transfer their programming to the broadcast site via microwave links. The proliferation of satellite dishes in residential backyards and on homes attests to the immense popularity of satellite TV, in which signals on the microwave bands are **uplinked** to, and **downlinked** from, satellites orbiting the equator.

Do the same waves both cook and carry communications?—most certainly! Microwaves are part of the **electromagnetic wave spectrum**, which contains waves of immensely varying properties, such as X-rays, ultraviolet light, visible light, and infrared, and those that carry AM and FM broadcast signals, among others. The form of these waves, however, is exactly the same—they differ only in **frequency.** More and more **hams** are taking an interest in microwave operation. Why this is just a recent phenomenon, and what their vast potential is, is the thrust of this month's column.

Long Known About

It's a little known fact that microwave communications has existed since the very early days of radio investigation. Guglielmo Marconi, the father of wireless radio, made his first major contribution to communications technology in 1897 by sending a microwave signal that was received several miles away.[1] As early as 1933, a commercial microwave link was set up across the English channel, which operated for many years.

Why haven't more hams ventured into these bands until recently? For a combination of reasons:

- Line-of-sight **propagation**. Except during highly unusual atmospheric conditions, microwaves travel in a straight line. Waves of much lower frequencies, generally those below 30 **MHz**, usually travel to the ionosphere, which refracts them back to Earth to points many miles away.
- Specialized components. Only very precise (and expensive) components could cleanly generate such high frequencies, at appreciable power levels.
- High **attenuation**. Microwave energy is absorbed much more by organic matter than are waves of lower frequencies. Even moisture greatly absorbs microwave energy at certain frequencies in the higher end of the microwave subspectrum. It's this property that makes microwaves ideal for cooking!

Much has changed, however. Commercial interests have been developing microwave systems in earnest in the past 20 years, which has increased the supply, and driven down the cost of microwave components and instruments that use microwaves. An example of this is the microwave oven—be sure to catch the article in this issue that shows you how to convert such a beast into an amateur television transmitter!

Transponder-equipped satellites for many communication services, including amateur radio, now orbit the Earth. They greatly increase the range of line-of-sight signals, and reduce the attenuation problem, since these signals do not encounter trees, mountains, and other energy-absorbing obstacles on their way to and from the satellite.

And what do these bands have in their favor? First and foremost is the vast amount of bandspace in the microwave region allocated for amateur use—one ham band alone there contains almost as much bandspace as all the ham bands below it combined![2] This permits much **wideband** operation, which is desirable since, the wider the signal, the more quickly it can convey information. There are many **modes** of operation, too, that hams can investigate in the microwave regions that aren't allowed in the lower frequency regions due to the narrower band allocations there. An example of an interesting wideband mode is amateur fast-scan television, much like commercial TV, on which several articles are featured here this month.

A second reason is that, for comparable **gain,** microwave antennas do not need to be as large as those needed for lower frequency signals. These antennas, too, are easily made to be extremely directive, which helps reduce unnecessary interference.

Microwaves offer a unique opportunity for hams to explore new techniques and methods of operation—and more cheaply than ever before. Come and explore this frontier!. . .de NS1B

References

[1]Marconi's best-known contribution to radio communications is the first transoceanic wireless transmission. In December 1901, Marconi sent the letter "S" from a site near St. John's Newfoundland, which was received in Poldhu, Cornwall.

[2]The 3 cm (10–10.500 GHz) band is 500 MHz wide. All the amateur bands below 3 cm to 160 meters total up to less than 510 MHz of bandspace. 73

GLOSSARY

Attenuation—Dampening, reduction.

Band—A group of contiguous frequencies.

Downlink—A signal that is sent from a satellite to an Earth-based station.

Electromagnetic wave spectrum—This represents the entire range of frequencies or wavelengths of electromagnetic wave energy. Radio waves typically range from 20,000 Hz (cycles per second) to 300,000 million Hz (cycles per second). The microwave portion of the spectrum is typically set at 1,000 million–300,000 million Hz, or cycles/second.

Frequency—One of the two terms that characterizes electromagnetic waves. It is the number of cycles of a wave that passes a given point in a given period of time. (A wave cycle is the distance of the wave from one peak to the next.) The frequency is usually given in cycles per second, commonly termed **Hertz** (Hz).

Gain—This describes the increase of voltage, current, or power. Gain is a ratio. A given transmitting antenna's gain, for example, is the strength of its radiated signals compared to the strength of the radiated signals of a reference antenna. Gain is usually represented in logarithmic units called **decibels** (dB).

Ham—Short for amateur radio operator.

MHz—Abbreviation for megahertz. This stands for "millions of cycles per second."

Mode—Mode has several meanings. In this case, it refers to the way information is imposed on a radio wave. AM and FM are two modes.

Propagation—This refers to the traveling of radio waves through a given medium, such as the atmosphere. The better the propagation, the further this energy travels through the medium.

Transponder—The unit on a satellite that receives a signal from Earth and simultaneously retransmits it back to Earth, on a frequency distant from the receive frequency.

Uplink—A signal sent from an Earth-based station to a communications satellite.

Wavelength—One of the two principal characterizations of an electromagnetic wave. The wavelength is conventionally measured from one wave peak to the next. This distance is usually given in meters or centimeters.

Wideband—Refers to a signal that occupies a relatively broad piece of spectrum. An AM broadcast signal, for example, takes up 6,000–8,000 cycles of bandspace, and is not considered very wideband. The signal that carries the combined audio and color video to your TV set, however, occupies a minimum of 6 million cycles of bandspace, making it comparatively wideband.

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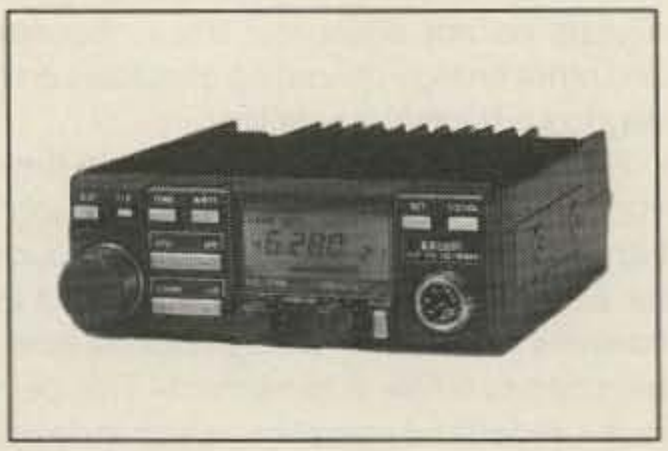

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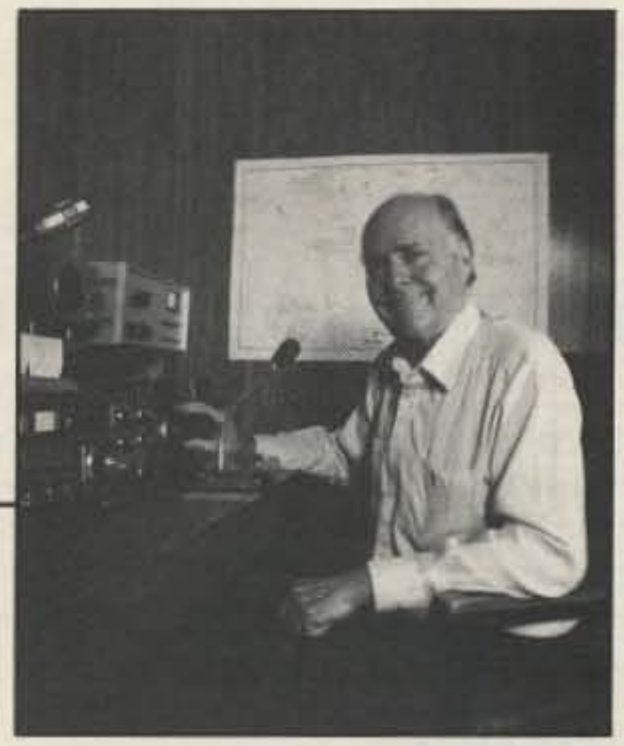

Beacons

With the gradual return of our blessed sun spots, it's getting on time to get organized with ham beacons on our higher bands. Yes, I know there are quite a few of them around the world already, but there isn't any serious organization of their efforts that I've seen.

It makes operating on our VHF and UHF bands a lot easier when there are beacon stations operating—particularly when there is an accepted standard beacon frequency on each band. Then all you have to do is tune to that channel and you'll hear when the band starts to open, and to where.

This is not exactly a new concept. Forty years ago the Radio Amateur Scientific Observations (RASO) group, organized by Perry Ferrell, set up beacon operation on 50.1 MHz. I converted an old SCR-522 transmitter to six meters and keyed it with a notched code wheel operating a microswitch, providing the beacon operation from New York City.

With ten meters opening more and more often, I'd like to see an agreed upon beacon frequency established. For ease of tuning I suggest it be on an easy-to-remember frequency, say 28.5 MHz. This would help the Novices now starting to use this band to spot openings.

Lest we have five hundred hams setting up beacons in one area, we're going to need some coordination. If I try to do it you'll just get mad at me for taking so long because I'm often away at shows, hamfests, and so on. This would seem an ideal job for a handicapped or retired ham with the time to keep records, answer the mail, and send reports for publication in *73*. Any volunteers?

Beacons are even more important on six meters, where we'll be seeing openings all around the world during the peak sun spot years. These are often short and surprising. Is 50.1 MHz still a good channel or have you a better idea?

How about two meters? It'd be nice to know when there's sporadic E, inversions, and so on. 144.1? Please advise.

And certainly we want beacon channels for 220 and 450 MHz. What are good channels?

That brings us to the beacon signals. With today's technology we won't have to rely on code wheels and microswitches. I'd like some ideas on how a large number of beacon stations around the world can use one frequency without undue interference. Identification can be automatic and fast—perhaps every few minutes to keep QRM minimal. With periodic sending it should be easy to have a receiver at the beacon station checking the channel for other beacons in between transmissions.

Our receivers can be set up to turn on a cassette recorder when a signal is received. In that way we'll have a record of the band opening whether we're home or not. There should be a way to also record the time, perhaps on the second cassette channel.

It's only a short step from this to automatic QSOs between beacon stations. If a beacon station receiver picks up another beacon during the listening period it could be programmed to call it and exchange callsigns, even with no operator present. But one step at a time—let's get some beacons organized first, then we'll worry about automatic contacts. And yes, we'll have articles in *73* on how to do all this, if you write 'em.

There, that ought to get you busy thinking. We need an international beacon coordinator, recommendations for beacon channels on each band, articles on keyers, simple ten watt rigs for this service (Why use a $1,000 synthesized transceiver to generate a ten watt one frequency signal?), identification ideas, etc. Let's get cracking on this.

Reality? What's That?

Let me see if I understand your perspective on things right. I just counted up the frequencies allocated to us by the FCC—it comes to 23,164.55 MHz. Of that, on a very good day, we're using maybe 39.55 MHz of our allocation. That comes to about 0.17% that we're actually using, about 1/500th.

Well, yes, but heck, we may need those unused frequencies in the future, right? By whom? For what? We haven't had any significant growth in over 25 years and there's none even in remote prospect ahead that I know about. We haven't invented or pioneered much since we stopped growing a generation ago—or in any other way honored our FCC charter as a "service."

We managed to virtually destroy the womb that kept us going—the thousands of school radio clubs. And now we're more interested in building monuments to our past, like the Don Wallace W6AM Museum in Palos Verdes and the Percy Maxim W1AW Museum in Newington, than we are in rebuilding the infrastructure that made our hobby possible.

Do I have it right? You are upset that the FCC is taking our virtually unused 220–222 MHz band and handing it over to UPS so we can have faster and cheaper parcel delivery? Maybe you'd like to go back to Parcel Post? And now you're getting upset over the FCC proposing to open several of our unused microwave bands to industry for radio gadgets as part of their recent Part 15 rewrite?

As I understand it, you have no plans for ever getting amateur radio growing again. You have no

Continued on page 53

QRX . . .

EDITED BY BRYAN HASTINGS NS1B

The Eleventh Hour!

Deadline for article submissions for the Home-Brew IV contest—1 July—fast approaches! Competition by now is stiff, but the rewards are great. (See below for details.) Phone Bryan at (603) 525-4201, Ex. 543 for an evaluation of your home-brew idea.

Contest Chairman Opening

***73 Magazine* is accepting applications for the position of Contest Chairman.** The duties, in brief, are: Bringing the current program up-to-date, and laying plans for future contests. Financial arrangement to be discussed. Those interested may contact Bryan NS1B at the address listed below, or phone (603) 525-4201. Ex. 543.

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Just scribbling a bunch of check marks across a single row on the card, and tossing a stamp on it and mailing it in, however, does *not* qualify you. I check to see that you've invested at least a few minutes of your time to fill it out. This doesn't mean you have to read every article in the book—just thoughtfully evaluate the ones you know. Above all, write in your comments and suggestions!

We add the one-year sub onto winner's current sub.

This month's winner is: R.R. DeJongh WB7CPT. Congratulations, and thanks for your input!

What's Old is New

Research teams in the US and abroad believe that vacuum tubes are the wave of the future. These tubes under development, however, will be exceptionally small, with diameters ranging from less than a human hair to only *100 atoms* across. They are being designed to fit right on or in silicon chips. Electrons will tunnel out of the solid ctor into the vacuum, so the tubes will ..e without filaments. The electrons will move faster than they would in a semiconductor because of lack of scattering, and current densities can be higher with less resistive heating.

Among the possible uses of these vacuum microelectronic devices are radiation resistant devices that have a wide temperature tolerance, and radios that operate up to 60 GHz.

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Two New 73 Departments

The amateur radio field is always in flux—products are constantly being improved, companies move, prices change, etc. Information in our articles and reviews has sometimes changed several times over by the time they get to print.

Now article and review updates have their own place. Submit these, and we will run them in "Updates," a department that debuts in the August issue. Also in "Updates," we will include corrections to those occasional errors that elude our watchful eyes!

"Ham Profiles," a monthly half-page devoted to two amateurs, will also begin in August. Hams are men and women of all ages and walks of life—and all with their own reasons for joining our broad global fraternity. Help us show this wonderful diversity to newcomers—send in a photo and a short description (150 words maximum!) of yourself or another person you think deserves a shot at a place in "Ham Profiles." We especially encourage entries from women hams, and hams in their twenties and younger.

$$ HOME-BREW IV $$

73 Magazine again invites all home-brewers to turn their hot solder into cold cash and prizes, and to get their name in print to boot. All projects have a chance to appear in the magazine, and we will handsomely reward the authors of the best of these.

Now for the bounty. Ramsey Electronics sweetened the pot from their line of frequency counters. First prize is $300, a 10-year subscription to *73*, and a CT-125 1.25 GHz frequency counter. Second prize is $150, a two-year sub, and a CT-90 600 MHz frequency counter. Third prize is $75, a two-year sub, and a CT-70 525 MHz frequency counter. All this is in addition to the payment every author receives for publishing in *73*.

Contest Rules

1. Entries must be received by 1 July 1989.
2. To enter, write an article describing your best home-brew construction project and submit it to *73*. If you've never written for *73*, send an SASE for a copy of our Writer's Guide, or download it from CompuServe (Hamnet forum, Library 0., filename "73WRIT"). *Be sure to state on the submission that it is for the Home-brew IV contest.*
3. Here's the real challenge: The total cost of your project must be under $73, even if all the parts were bought new. Be sure to include a detailed parts list with prices and sources.
4. Our technical staff will evaluate each project on the basis of originality, usefulness, reproducibility, economy of design, and clarity of presentation. The decision of the judges is final.
5. All projects must be original. That is, they must not be published elsewhere. There is no limit to the number of projects you may enter.
6. If your article is accepted, *73 Magazine* will, upon publication, purchase first North American serial rights.
8. Mail your entries to: 73 Magazine
WGE Center
Forest Rd.
Hancock NH 03449
Attn: Home-Brew IV

QSL of the Month

One of our more painful tasks is rejecting outright many "QSL of the Month" submissions. To save all of us energy, go through the following checklist before submitting it:

—Is it color? We rarely, if ever, run black and white. Also, we don't reproduce silver or gold.

—Is it a postcard? We can't accept these.

—Is it obscene? Don't bother sending it. (At least don't expect us to print it!)

—Is it already a photo? Chances are that it will appear too fuzzy for print after color separation.

Uncle Wayne's QSLs

We have pulled the QSL ad from our magazine and stopped printing them for the time being. We expect to resume the service in several months, when we settle on an out-of-house printer. Stay tuned for further developments.

They'll Have Your Number!

Ever make an autopatch to a law enforcement number? After you pass your traffic, they ask your name, address, and telephone

KENWOOD

...pacesetter in Amateur Radio

All New!

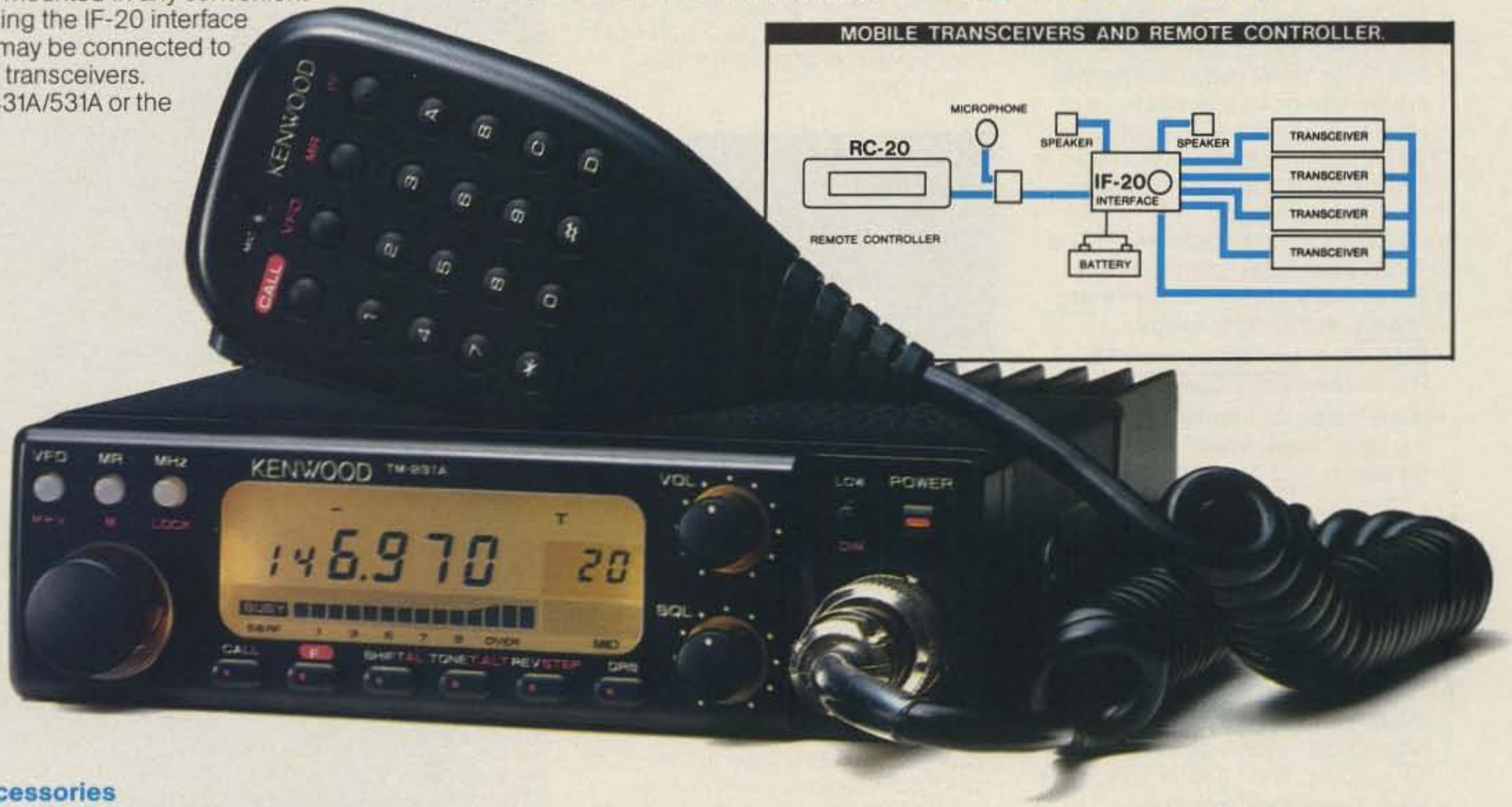
Stacked in Your Favor!

TM-231A/431A/531A

FM Mobile Transceiver

Looking for a compact transceiver for your mobile VHF and UHF operations? KENWOOD has a compact rig for each of the most popular VHF/UHF bands.

- **20 multi-function memory channels.**
  20 memory channels allow storage of frequency, repeater offset, CTCSS frequency, frequency step, Tone On/Off status, CTCSS and REV.
- **High performance—high power! 50W (TM-231A), 35W (TM-431A) with a 3 position power switch (high, medium, low).**
- **Optional full-function remote controller (RC-20).**
  A full-function remote controller using the Kenwood bus line, model RC-20, may be easily connected to the TM-231A/431A/531A and can be mounted in any convenient location. Using the IF-20 interface the RC-20 may be connected to four mobile transceivers. (TM-231A/431A/531A or the TM-701A)
- **Multi-function DTMF mic. supplied.**
  Controls are provided on the microphone for CALL (Call Channel), VFO, MR (Memory Call or to change the memory channel) and a programmable function key. The programmable key can be used to control one of the following on the radio: MHz, T. ALT. TONE, REV, DRS, LOW or MONITOR.
- **Easy-to-operate illuminated keys.**
  A functionally designed control panel with backlit keys increases the convenience and ease of operation during night-time use.
- **Auto repeater offset on 144 and 220 MHz.**
- **Built-in digital VFO.**
  a) Selection of the frequency step (5, 10, 15, 20, 12.5, 25kHz)
  *TM-531A: 10, 20, 12.5 25kHz
  b) Programmable VFO
  The user friendly programmable VFO allows the operator to select and program variable tuning ranges in 1 MHz band increments.
- **Programmable call channel function.**
  The call channel key allows instant recall of your most commonly used frequency data.
- **Selectable CTCSS tone built-in.**
- **Tone alert system—for true "quiet monitoring"!**
  When activated this function will cause a distinct beeper tone to be emitted from the transceiver for approximately 10 seconds to signal the presence of an incoming signal.
- **Easy-to-operate multi-mode scanning.**
  Band scan, Program band scan, Memory scan plus programmable memory channel lock-out, with time operated or carrier operated stop.
- **Priority alert.**
- **DRS (Digital recording system).**
  The optional DRU-1 can store received and transmitted messages for up to 32 seconds, allowing the operator to quickly check or return any call using the tone alert system.
- **Automatic lock tuning function (TM-531A).**
- **Repeater reverse switch.**



MOBILE TRANSCEIVERS AND REMOTE CONTROLLER.

Optional Accessories

- **RC-20** Full-function remote controller
- **RC-10** Multi-function remote controller
- **IF-20** Interface unit handset
- **DRU-1** Digital recording unit
- **MC-44** Multi-function hand mic.
- **MC-44DM** Multi-function hand mic. with auto-patch
- **MC-48B** 16-key DTMF hand mic.
- **MC-55** 8-pin mobile mic.
- **MC-60A/80/85** Desk-top mics.
- **MA-700** Dual band (2m/70cm) mobile antenna (mount not supplied)
- **SP-41** Compact mobile speaker
- **SP-50B** Mobile speaker
- **PS-430** Power supply
- **PS-50** Heavy-duty power supply
- **MB-201** Mobile mount
- **PG-2N** Power cable
- **PG-3B** DC line noise filter
- **PG-4H** Interface connecting cable
- **PG-4J** Extension cable kit
- **TSU-6** CTCSS unit

Specifications and prices subject to change without notice or obligation.
Complete service manuals are available for all Kenwood transceivers and most accessories.

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P.O. BOX 22745, 2201 E. Dominguez Street
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Mississauga, Ontario, Canada L4T 4C2

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...pacesetter in Amateur Radio

220 MHz TH-315A Here Now!

This HT Has it All!

TH-215A/315A/415A

Full-featured Hand-held Transceivers

Kenwood brings you the greatest hand-held transceiver ever! More than just "big rig performance," the new TH-215A for 2 m, TH-315A for 220 MHz, and TH-415A for 70 cm pack the most features and the best performance in a handy size. And our full line of accessories will let you go from hamshack to portable to mobile with the greatest of ease!

- **Wide receiver frequency range.** Receives from 141-163 MHz. Includes the weather channels! Transmit from 144-148 MHz. Modifiable to cover 141-151 MHz (MARS or CAP permit required).
- **TH-315A covers 220-225 MHz, TH-415A covers 440-449.995 MHz.**
- **5, 2.5, or 1.5 W output, depending on the power source.** Supplied battery pack (PB-2) provides 2.5 W output. Optional NiCd packs for extended operation or higher RF output available.
- **CTCSS encoder built-in.** TSU-4 CTCSS **decoder** optional.
- **10 memory channels store any offset, in 100-kHz steps.**
- **Odd split, any frequency TX or RX, in memory channel "0."**
- **Nine types of scanning!** Including new **"seek scan" and priority alert.** Also memory channel lock-out.
- **Intelligent 2-way battery saver circuit extends battery life.** Two battery-saver modes to choose, with power saver ratio selection.
- **Easy memory recall.** Simply press the channel number!
- **12 VDC input terminal for direct mobile or base station supply operation.** When 12 volts applied, RF output is 5 W! (Cable supplied!)
- **New Twist-Lok Positive-Connect™ locking battery case.**
- **Priority alert function.**
- **Monitor switch to defeat squelch.** Used to check the frequency when CTCSS encode/decode is used or when squelch is on.
- **Large, easy-to-read multi-function LCD display with night light.**
- **Audible beeper to confirm keypad operation.** The beeper has a unique tone for each key. DTMF monitor also included.
- **Supplied accessories:** Belt hook, rubber flex antenna, PB-2 standard NiCd battery pack (for 2.5 W operation), wall charger, DC cable, dust caps.

Optional Accessories:

• PB-1: 12 V, 800 mAH NiCd pack for 5 W output • PB-2: 8.4 V, 500 mAH NiCd pack (2.5 W output) • PB-3: 7.2 V, 800 mAH NiCd pack (1.5 W output) • PB-4: 7.2 V, 1600 mAH NiCd pack (1.5 W output) • BT-5 AA cell manganese/alkaline battery case • BC-7 rapid charger for PB-1, 2, 3, or 4 • BC-8 compact battery charger • SMC-30 speaker microphone • SC-12, 13 soft cases • RA-3, 5 telescoping antennas • RA-8B StubbyDuk antenna • TSU-4 CTCSS decode unit • VB-2530: 2m, 25 W amplifier (1-4 W input) • LH-4, 5 leather cases • MB-4 mobile bracket • BH-5 swivel mount • PG-2V extra DC cable • PG-3D cigarette lighter cord with filter

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications and prices are subject to change without notice or obligation.

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QRX . . .

number. Quite often, we do not want to give that information over the air. Not doing so, however, may cast suspicion on the credibility of your information.

The way around this? Give them just your driver's license number! When the dispatcher asks, just say "Please copy my (State) DL number XXXXX." It's a good idea to write this down on your emergency autodial number card, for instant access.

Superlink

A group of Canadian hams is working hard to expand a private transcontinental radio link that will make other North American networks pale in comparison. The project is called I-PARN—the Interprovincial Amateur Radio Network. I-PARN is projected to be a full-time Canada-wide network for both voice and digital communications.

What separates I-PARN from links like the Condor connection in California or the Zia Connection in the southwestern US is both the scope of its coverage and the type of linking. I-PARN will link repeaters using ground stations and commercial geostationary communications satellites! Once in place, this network will permit amateurs in any major city in Canada to speak at leisure with their counterparts in other population areas with only a two meter HT.

I-PARN is conducting a membership drive across Canada to get funding to complete the network. Hams in the lower 48 states shouldn't get their hopes up, however, as there are no plans to extend I-PARN south of the border.

Be Kind to Your Low-Power Friends

QRP and QROers alike take note of the following list of HF QRP frequencies: 1.810, 3.560, 7.030–7.040, 10.106, 14.060, 21.060, and 28.060 MHz. Kilowatters, please give these frequencies as wide a berth as possible.

QRPers' Delight

The British journal *New Scientist* recently published an article on a newly developed superconducting antenna (Oct. 29, 1988, page 38). It states that engineers at the University of Birmingham, England, made an antenna that radiates virtually all the energy it receives when properly loaded. The experiment was conducted with a dipole made from the new high temperature superconductor: yttrium-barium-copper oxide. The gain at 550 MHz was 16 times that of a copper antenna of equal length operating at room temperature.

FCC Just Says "No."

The FCC Commissioners upheld the Private Radio Bureau's decision denying a request from Anthony Sivo W2FJ to amend the amateur rules to authorize single sideband in the 30 meter band. The Commissioners agreed with the Bureau's conclusion that the need for SSB transmissions in the 30 meter band had not been established and there were already ample frequencies available for sideband operations.

The FCC also denied RM-6559. This one would have allowed Technician class operators to use teleprinting and packet in the Novice and Technician segments of the 80, 40, and 15 meter bands. The petitioner, Nicholas Sayer N6QQQ said that the additional privilege for Technician operators would be an incentive for Novice operators to upgrade. The Commission countered that the Technician class is currently the fastest growing amateur license, and there was no need to offer additional incentives for Novice class operators to upgrade to the Tech.

And finally, the FCC's Private Radio Bureau denied a petition by Shannon Cisco WB4AZT to change the amateur operator license requirements for senior citizens. Cisco had requested that amateurs over 65, licensed for 20 years, be automatically upgraded from Technician to General, General to Advanced, or Advanced to Extra Class respectively, without any further testing. Cisco's original request had been denied. He appealed the Order to the FCC Commissioners, who upheld the Private Radio Bureau's decision.

Electronic Road Maps

Electronic road maps are already available in California ($1,400) which not only tell you where you are, but the best way to get to your destination. An arrow marks your car's position on a green street grid on a 4.5" dashboard monitor. As the car moves, the map display moves with it, rotating as the car turns to match what you see through the windshield. A personal computer in the trunk controls the system.

Soon to be marketed are radar guided systems to detect and avoid obstacles, communications devices that provide real-time traffic information, and smart cruise controls that sense when there is a vehicle ahead, so that you can maintain a safe distance.

Who's 9G1R?

The Japan Amateur Radio League (JARL) receives a considerable amount of QSLs for a station that claims to be 9G1R. Please don't send JARL your card for this station—they do not have any QSL routing info for it.

17m WAS

The first 17 meter Worked All States award has been issued to Christopher Merchant KA1LMR on 1 March, after Chris became the first to submit his cards to the ARRL headquarters.

Speakers' Bureau

***Westlink Report* in California recently created a Speakers' Bureau.** The Bureau will act as a clearing house for the expertise of speakers willing to attend conventions and hamfests and make presentations in their specialties without any honoraria. Groups requesting a speaker must provide transportation (of the speaker's choice), lodging, meals, and any miscellaneous expenses incurred by the speaker.

The following people are currently available:

—Phil Anderson W0XI, President of Kantronics, Inc., 1202 E. 23 Street, Lawrence KS 66046. Area of expertise: digital communications.

—Chod Harris VP2ML, Editor of *The DX Bulletin*, Fulton, California. His address is PO Box 4881, Santa Rosa CA 95402. Chod has four prepared talks dealing with DX: Christmas and Easter Islands, The Galapagos, African Odyssey, and how the *DX Bulletin* is published.

—Bill Pasternak WA6ITF, 28197 Robin Ave., Saugus CA 91350. Areas of expertise: amateur radio promotion, television production, broadcast/consumer VCR/VTR maintenance, VHF/UHF repeaters, and frequency coordination.

—Bill Waters WA6OLW, 825 La Crosse Ct., Sunnyvale CA 94087. Bill is the former Operations Manager of Sunnyvale USAF Satellite Test Center and is a Communications Engineer with Ford Aerospace. Areas of expertise: antenna experimentation, microwave hardware development, propagation, and low-noise systems.

Please contact the speaker you want directly at the address listed. Potential speakers are urged to join this service at no cost.

Thanks . . .

To all those who contributed to this month's QRX column. They are: *Westlink, JARL, W4CA Log*, and N5KOB Keep sending in those photos and news items! Address them to: *73 Magazine*, Forest Rd., Hancock, NH 03449, Attn: QRX.

10 Meter Survival Guide

Check out this "most-moded" HF band!

by Chuck Scott N8DNX

If you think 10 meters is just another ham band, you're in for quite a surprise. After a long period of poor propagation and relative neglect, this band has come alive with a vengeance. The combined forces of Novice Enhancement, new transmission modes, a flood of equipment, and what may be the best solar cycle yet, are beating on the door of ham radio. Are you ready?

10 Meter Band Plan

The FCC rules and regulations give us the official word on band use. But there's more to the story. By general agreement, and some prodding by various organizations, the band has been divided into a maze of allocations and sub-bands. (See Figure 1.) Knowing and following these voluntary assignments can make you a more efficient and courteous operator. More than that, knowing what's there, and where to find it, can only add to your enjoyment.

When is Ten Open?

Before you call CQ, find out which parts of the world are open to your QTH by scanning the area from 28.190 to 28.300 MHz. The propagation beacons found there will frequently surprise you. Check your Callbook or page 103 of the Jan '88 *73* for a list of 10 meter beacons. One beacon of particular interest is the IY4M robot on 28.195 MHz. Try giving it a call sometime.

In the future, expect an integrated beacon system to begin operating in a round robin fashion near 28.200 MHz. A similar system has been in operation for some time on 14.100 MHz.

These beacons generally run with very low power (some less than a Watt!) and you can often hear them when the rest of the band sounds dead. Perhaps this should be a lesson to those who question CW's ability to get through during marginal band conditions!

Speaking of CW

Having been inspired by low-power beacons, you should go QRP and tune around the 28.040 or 28.060 MHz calling frequencies for low power operations. Be warned, though: Some of these guys consider real QRP to be anything under 100 mW!

By comparison, a Novice or Technician can be a real powerhouse on 10 CW with ample opportunity for exciting DX. Just take note of the two popular packet frequencies in this area.

Digital Modes

Most packet activity on 10 meters is centered around two frequencies. Check 28.105 MHz for 300 baud operation or 28.205 MHz for 1200 baud. One important note, FM packet is not allowed on the 10 meter band below 29.2 MHz.

RTTY and AMTOR enthusiasts should look at the region of 28.090 to 28.100 MHz.

The Flood Gates are Open

Depending on your point of view, Novice Enhancement is either something unmentionable or a real boon for the hobby. Whatever you think, a quick scan across the Novice/Technician SSB portion of the band when 10 meters is open is a real eye-opener. An influx of economical new radios, and a wave of the FCC's hand, have moved the bulk of the SSB activity down below 28.500 MHz. Low power mobiles and stations with very modest antennas can easily pick up QSOs in this region.

While there isn't a real standard yet, 28.400 MHz is a good gathering place for mobiles to pick up QSOs. If the frequency starts getting busy, move your contacts down away from this calling frequency.

If you think it takes a full "gallon and a half" to bust into a DX pileup, you should try again. On 10 meters, any station can catch a rare one by using courtesy and persistence, even low power mobiles! Listen to what's happening and try to figure out what catches the DX station's ears.

Moving up the Band

The middle of the General phone band is home to some big time rag-chewing—try calling around 28.600 MHz. Look for SSTV activity between 28.675 and 28.685 MHz, or on 28.945, if you're into FAX. Another interesting feature is the continuous code practice transmission at 28.888 MHz which comes from W6IRT's QTH (N. Hollywood, CA) running only 5 Watts into a ground plane antenna.

AM operation has a frontier outpost between 29.000 and 29.200 MHz, with 29.000 being a common calling frequency. Many modern radios are equipped with this mode, including the popular Uniden HR-2510. With this kind of backing, 10 AM should see a significant increase in popularity.

Rugby and 10 FM

To the newcomer, both rugby and 10 FM seem uncivilized with few survivors. Well, maybe that's true about rugby, but 10 FM can have a more dignified manner. Occasionally referred to as the Channel 19 of amateur radio, the FM calling frequency of 29.600 MHz has earned its reputation. As you listen in, you might be surprised by the "no holds barred" activity.

Part of the problem is a proliferation of "links," secondary transceivers connected to VHF and UHF repeater systems. Some of these operate exclusively on this channel. Rarely out of control, but sometimes innocently left on, they faithfully retransmit the activity of their parent repeater. Users of these links should take extra caution to ensure their proper operation, and configure them without courtesy tones or hang time. A properly operated link can be exciting for repeater users. Link owners should add to that excitement with at least one more frequency to which they can QSY.

With such heavy congestion on the calling frequency, stations need to move off quickly and continue their QSO elsewhere. The best place to QSY is 29.200 to 29.300 MHz, where you can also find a common DX calling frequency. The reason for going so far down the band is to avoid interference with repeater inputs and outputs and satellite downlinks. Keep in mind that a 10 meter FM signal is about 10 kHz wide. FM signals can easily interfere with an FM receiver 10 kHz away, or totally obliterate a CW or SSB signal 5 to 8 kHz away. 10 meter FM operation is quite channelized—stick to the even numbered 10 kHz channels (i.e., 29.220, 29.240...) to avoid problems.

Repeater operation on 10 meters is nothing like its VHF or UHF counterpart. Frequent propagation over large areas, and only four available repeater pairs, often result in many repeaters being heard on the same frequency. Use your best judgment to avoid keying up repeaters which may interfere with ongoing QSOs. I think in the future we will see some solutions, perhaps PL. In the meantime, keep up with 10 meter repeater activity

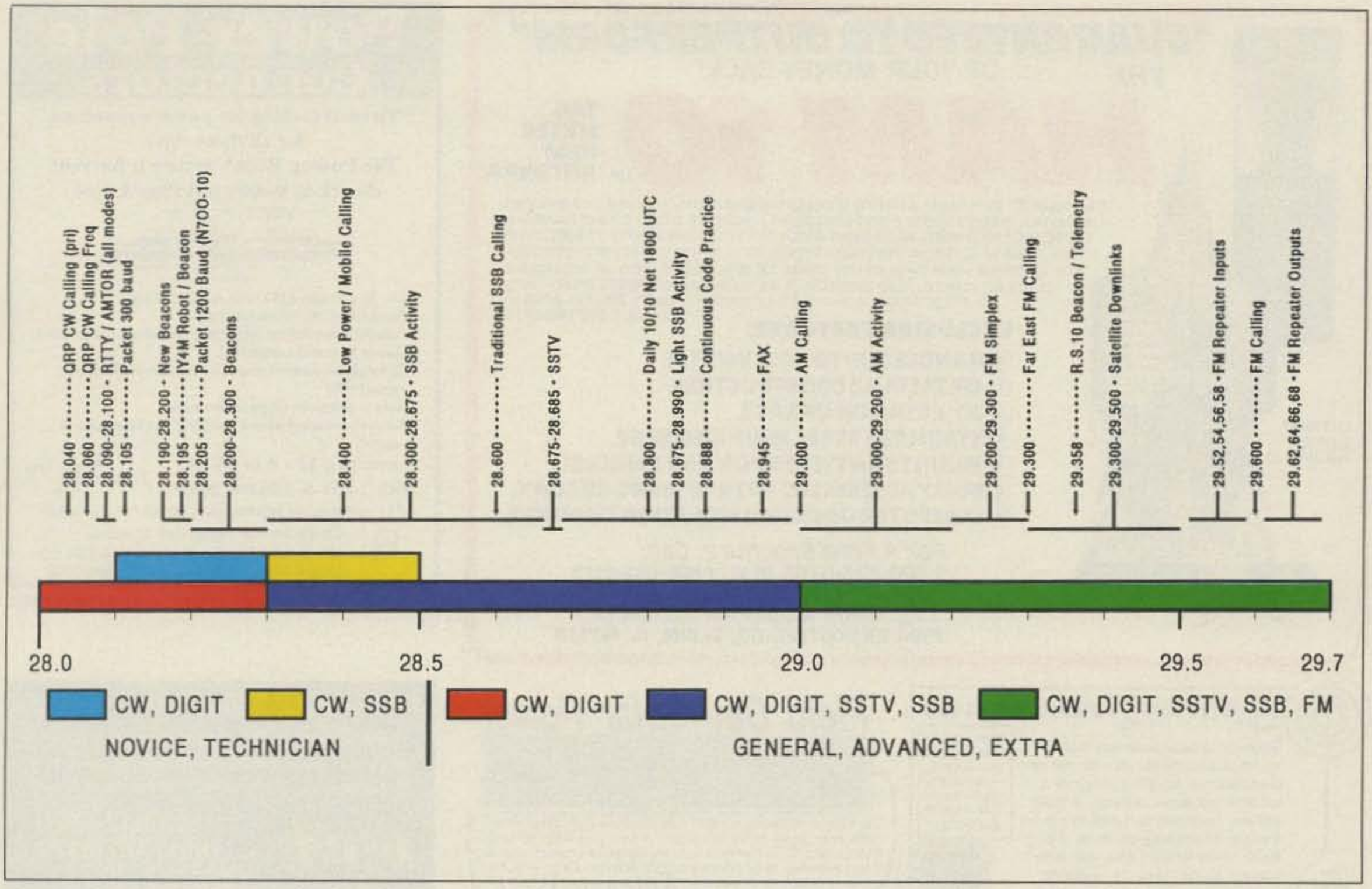

Figure 1. Mode and license class allocations for 10 meters.

by joining the Ann Arbor 10 meter Repeater Net on 29.54/64, Monday evenings at 0000 UTC.

Satellites, Too

Downlinks located between 28.300 and 28.500 MHz are paired with uplinks on other bands. Since satellite operators aren't transmitting on 10 meters, they often can't tell you that you're interfering with them. Even though RS-10/11 seems to be all that's active at this time, more satellites are expected to use 10 meters. Listen around 29.358 MHz for the RS beacon and telemetry. When you hear it, tune up toward 28.400 MHz for the downlink passband.

Ten meters is frequented by a number of contests and regular nets. The familiar sound of "CQ TEN TEN" is the result of Ten-Ten International, which currently conducts a daily net on 28.800 MHz at 1800 UTC. They sponsor numerous awards and in the process have helped keep the 10 meter band active during long periods of poor propagation. Ten-Ten International boasts nearly 50,000 members.

It's easy to see why 10 meters is rapidly becoming a showplace for amateur radio. Solar Cycle 22 is providing 10 meter openings to all parts of the world, inspiring new hams and old-timers alike. Novice Enhancement, inexpensive radios, relatively small antennas, excellent propagation, and a wide range of active modes, provide the excitement. Courteous operation and understanding of the voluntary band plan make it work. Now that you know where the action is, enjoy it! 73

For More Information, Contact . . .

Satellite Operation
AMSAT N.A.
PO Box 27
Washington DC 20044

Packet
TAPR
PO Box 22888
Tucson AZ 85743-2888

VADCG
9531 Odlin Rd.
Richmond, BC V6X-1E1
Canada

AM
AM Press Exchange
2116 Old Dover Dr.
Woodlawn TN 37191

Ten-Ten International
18130 Bromley St.
Tarzana, CA 91356

MFJ TUNERS

MFJ's *Best* 300 Watt Tuner gives you minimum SWR from 1.8-30 MHz ... *plus* you get MFJ's new *peak* and average reading Cross-Needle SWR/ Wattmeter, dummy load, 4:1 balun, antenna switch and more ... $149.95

The MFJ-949D gives you more precise matches and lower SWR than **any** tuner that uses two tapped inductors. Why? Because you get two **continuously** variable capacitors that give you infinitely more positions than the **limited** number on switched coils.

This gives you the precise control you need to get your SWR down to a minimum. After all, isn't that why you need a tuner? Covers 1.8-30 MHz.

You get MFJ's **new** lighted 2-color **peak** and average reading Cross-Needle SWR/Wattmeter that shows you SWR, forward and reflected power - all at a single glance. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, $9.95.

MFJ-949D
$149.95

You get a 4:1 balun for balanced lines and a 50 ohm 300 watt dummy load for tuning your exciter.

You get a 6-position antenna switch for selecting 2 coax lines (direct or through tuner), random wire, balanced line or dummy load.

You get a beautiful black all aluminum cabinet that matches your rig. Its compact size (10x3x7 in.) fits right into your station.

With MFJ's **best** 300 watt PEP tuner you get an MFJ tuner that has earned a reputation for being able to match just about anything - one that is highly perfected and has years of **proven** reliablity. Order yours today!

2-knob *Differential-T*™ Tuner

MFJ-986
$269.95

The **new** MFJ-986 Differential-T™ 2-knob Tuner uses a differential capacitor to make tuning foolproof and easier than ever. It ends constant re-tuning with broadband coverage and gives you minimum SWR at only **one** best setting. Covers 1.8-30 MHz.

The roller inductor lets you tune your SWR down to absolute minimum. 3-digits turns counter lets you quickly return to your favorite frequency.

You get MFJ's **new** peak and average reading Cross-Needle SWR/Wattmeter with a **new** directional coupler for more accurate readings over a wider frequency range. It reads forward/reflected power in 200/50 and 2000/500 watt ranges. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, $9.95.

A **new** current balun for balanced lines reduces feedline radiation and forces equal currents into antenna halves that are not perfectly balanced for a more concentrated, stronger signal. Add $10 s/h.

MFJ's *Fastest Selling* Tuner

The MFJ-941D is MFJ's fastest selling 300 watt PEP antenna tuner. Why? Because it has more features than tuners costing much more and it matches everything continuously from 1.8-30 MHz.

MFJ-941D
$109.95

It matches dipoles, vees, verticals, mobile whips, random wires, banlanced and coax lines.

SWR/Wattmeter reads foward/reflected power in 30 and 300 watt ranges. Antenna switch selects 2 coax lines, direct or through tuner, random wire, balanced line or tuner bypass. Efficient airwound inductor gives lower losses and more watts out. Has 4:1 balun. 1000 V capacitors. 10x3x7 inches.

MFJ's *Random Wire* Tuner

MFJ-16010 **$39.95**

You can operate all bands anywhere with any transceiver when you let the MFJ-16010 turn any random wire into a transmitting antenna. Great for apartment, motel, camping operation. Install a wire anywhere! Tunes 1.8-30 MHz. 200 watts PEP. Ultra small 2x3x4 in.

MFJ's *Very Best* Tuner

MFJ-989C
$349.95

The MFJ-989C is not for everyone. **However,** if you do make the investment you get the finest 3 KW PEP tuner money can buy - one that takes the fear out of high power operation and one that lets you get your SWR down to absolute minimum. Covers 1.8-30 MHz.

The MFJ-989C is a compact 3 KW PEP roller inductor tuner with a new **peak** reading Cross-Needle SWR/Wattmeter with a new, more accurate directional coupler. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, $9.95. With **three continuoualy** variable components you get precise control over SWR **and** the widest matching range possible.

You get a two core balun wound with teflon wire for balanced lines a 6-position antenna switch.

10¾x4½x15 inch cabinetin your station. Dummy load, tilt stand, turns counter. Add $10 s/h.

MFJ's *Mobile* Tuner

MFJ-945C
$89.95

Don't leave home without this **mobile** tuner! Have an uninterrupted trip as the MFJ-945C **extends your antenna bandwidth** and eliminates the need to stop, go out and adjust your mobile whip.

You can **operate anywhere in a band and get low SWR.** You'll get maximum power out of your solid state or tube rig and it'll run cooler and last longer.

Small 8x2x6 inches uses little room. **SWR/ Wattmeter and convenient placement of controls make tuning fast and easy while in motion.** 300 watts PEP output, efficient airwound inductor, 1000 volt capacitors. Mobile mount, MFJ-20, $3.00.

144/220 MHz VHF Tuners

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Inexpensive Hardline

Easy conversion of 75Ω CATV hardline for 50Ω systems.

by Edward Krome KA9LNV

Like many hams, I always look for new facets of the amateur radio hobby to explore. This exploration tends towards the higher and higher bands, especially the microwave bands, where wide ham allocations allow for experimentation with a variety of modes. This article describes an easy way to overcome one of the hardware hurdles in UHF and above operation—the expense of low-loss cable.

The Problem

My latest project has been Mode L operation on AMSAT-OSCAR-13. Mode L uses a 23 cm uplink and a 70 cm downlink. I recently built up equipment for the 1269 MHz uplink, but found the strength of my signal less than what I would like. I only have about 13 Watts of power and a single 45-element loop yagi on that band. This should be adequate, but that 13 Watts must actually be at the antenna feedpoint rather than in the shack looking at a lot of cable. At 23 cm, even the best "standard" coaxial cable is not very good. Good quality RG-8 has 10 dB attenuation per 100 feet and is almost unusable. Even Belden 9913, considered about the best available, gives almost 6 dB loss per 100 feet. Losing 6 dB means that only one quarter of what you put into the cable actually comes out 100 feet later. As anyone who has ever acquired 23 cm equipment will tell you, those are pretty expensive Watts to heat cable with!

Finding an Answer

Increasing signal strength boils down to either increasing the power out or decreasing antenna system loss. I decided to concentrate on line loss. My investigation of really good cable (such as ⅞-inch 50Ω Heliax, at almost $5 per foot with $55 connectors) left me cold. After all, my children do have to eat.

Soon, however, a readily available cable caught my eye—the ¾-inch diameter aluminum-jacketed hardline used for CATV. This cable has some great properties—it loses less than 3 dB per 100 feet at 1.2 GHz, and it's inexpensive (usually free or nominal). It has, however, two main drawbacks: it's a 75Ω line (which matches nothing commonly used in ham applications), and poses mechanical problems with its aluminum jacket and copper-coated aluminum center conductor that tax the ingenuity of the home-brewer. This article shows you how to overcome these two problems.

Where To Get CATV Cable

CATV companies buy this cable in huge rolls. Time economies and signal considerations mean that they will frequently either sell or give away roll ends too short for their use. These roll ends can be quite long by amateur standards—one I was given contained almost 500 feet of brand new cable! Polite inquiries with the local CATV companies are a good place to start.

Electrical Requirements

According to the *ARRL Handbook* and *Antenna Book* (Transmission Line section, any recent year), all you have to do to use cable of one impedance in a system of differing impedance is to match the two impedances with a quarter-wave impedance transformer. This is just a section of transmission line whose impedance is equal to the square root of the product of the two impedances you are trying to match, and cut to one quarter of the free space wavelength at the frequency of interest. That's all! In equation form, the required matching impedance Z_{im} is:

$$Z_{im} = \sqrt{50\Omega \times 75\Omega} = 61.2\Omega$$

So, in order to use 75Ω line in a 50Ω system, you must add a 61.2Ω impedance matching section to each end of the 75Ω line.

The *Handbook* also tells you how to construct a coaxial line. The impedance of an air-insulated coaxial line is determined by:

$$Z = 138 \log (ID/OD)$$

ID is inner diameter of the outer conductor, and OD is outer diameter of the inner conductor. Rearranging, for Z = 61.2Ω, any combination of tubing with an ID/OD ratio of 2.776 will provide the required impedance.

There's been a number of impedance converters published in amateur literature, but most use "non-standard" materials. "Standard" is what you can buy in a hardware store or plumbing shop. I devised a Z-matching device using a readily-available material—¾-inch copper pipe.

This copper pipe, in its most common form, is actually 0.875 inch in outside diameter and has a 0.032-inch wall. This yields a 0.810-inch inside diameter. Looking at the ID/OD requirements, the closest available standard hobby brass tube for an inner conductor is 9/32 (0.281)-inch diameter. Plugging these dimensions into the above formula gives an impedance of 63.4Ω. It's unlikely this variance from the actual requirements for a perfect impedance match would seriously degrade the performance. A purist could silver-plate the brass up to 0.292-inch OD and be exact.

You determine the length of the quarter wave section by the frequency desired. Since these devices are quite broadband, one length covers a given band. The 1296 MHz version, for example, works well on 1269 MHz. From the formula for free space wavelength, which also applies to air-insulated transmission lines:

¼ wavelength (feet) = 246 / F (MHz)

or

¼ wavelength (inches) = 2952 / F (MHz)

Interestingly, since 2 meters, 70 cm, and 23 cm are all harmonically related, and one quarter wave on 2 meters equals three quar-

Continued on page 18

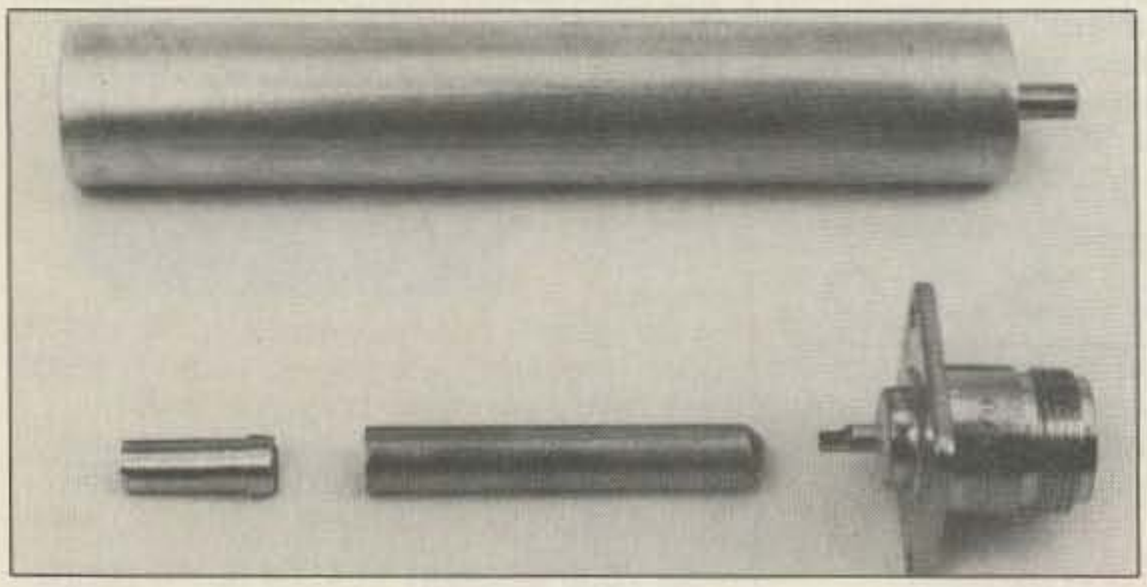

Photo A. Parts required for a single impedance converter. Note the spacer sleeve and outer shell (top row), and the center contact, center conductor with necked-down end, and the UG-58 (type "N") coaxial connector. The screw clamp is not shown.

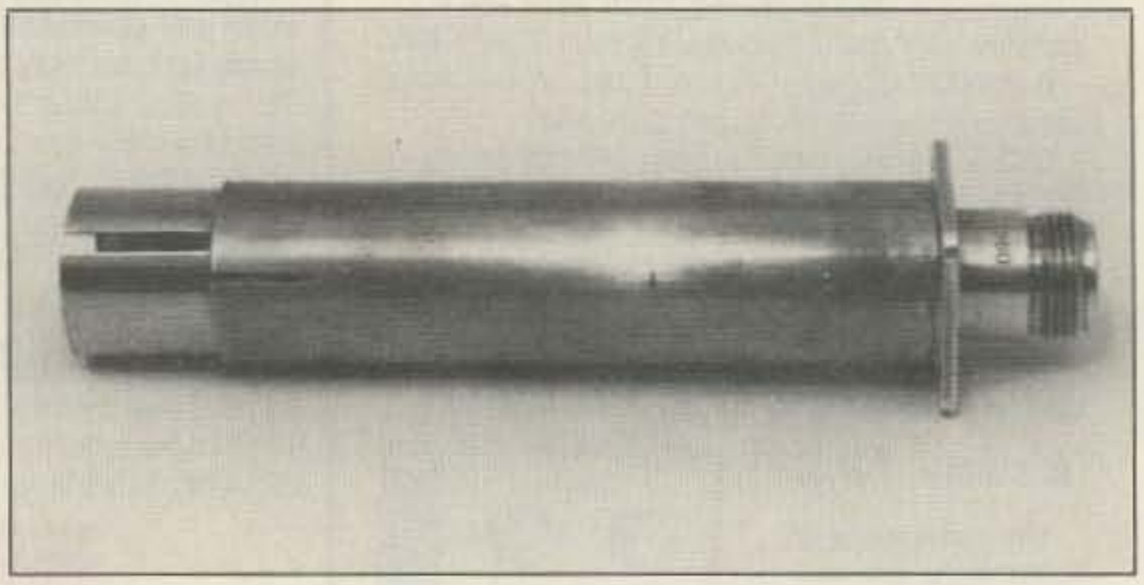

Photo B. Complete 23 cm impedance converter in process of being assembled to ¾-inch CATV hardline. Assembly will be complete when spacer sleeve is pressed in place between the outer shell and the hardline itself, and the screw clamp is installed.

FEEDBACK

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Continued from page 16

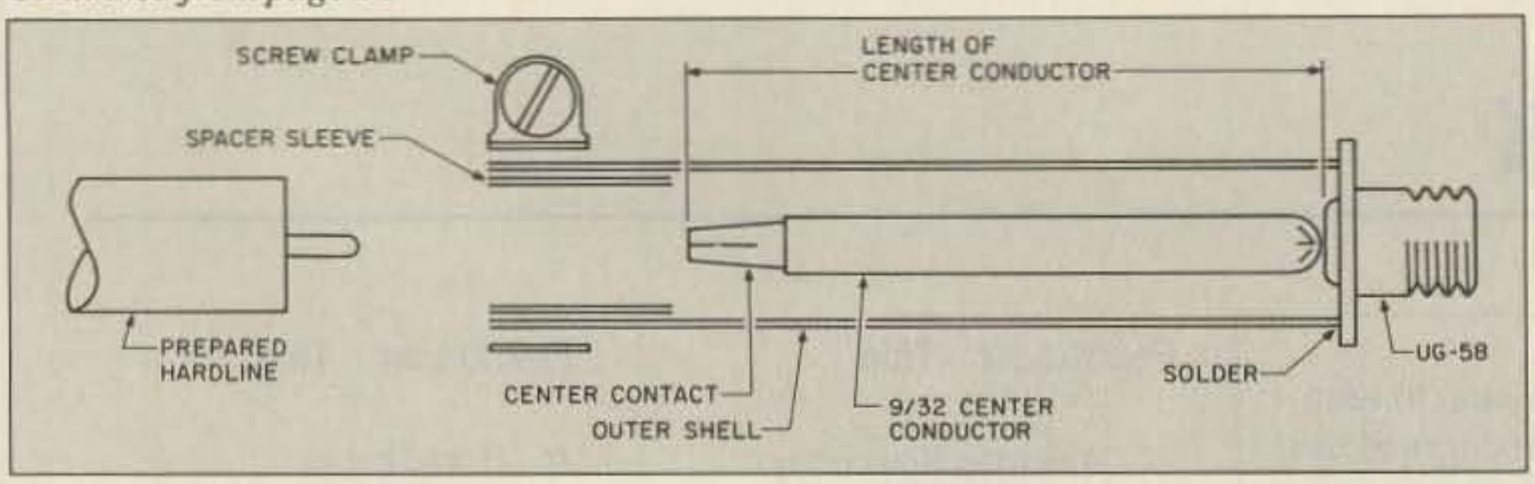


Figure 1. Cutaway of ¼ wave impedance converter, showing all parts of the completed unit.

ters on 432 MHz and nine quarters on 1296 MHz, you could theoretically use a single line and set of 2-meter impedance converters for all three bands. There are a few problems, however, with this "one line and matcher fits all." First, the more quarter wavelengths you use, the narrower the frequency response becomes, and the more likely that your impedance matching sections will become attenuators if they are not right on the money. Second, a single feedline precludes full-duplex crossband operation required for satellite work. Finally, at those frequencies, the cost of remote mounted antenna switching relays would far exceed the cost of separate feedlines!

Construction

The following construction plans appear to be the easiest 50Ω to 75Ω impedance matching arrangement to duplicate, using the most common materials I've run across. Although this project was originally intended for Mode L uplink use only, Table 1 includes dimensions for all popular VHF/UHF bands.

Parts

Build two identical units for each cable.

•Outer Conductor: Standard ¾-inch copper pipe, available at any plumbing supply house or hardware store. Insure that it actually measures ⅞" (0.875") outside diameter and has a 0.032" wall thickness.

•Inner Conductor: Hobby brass tubing measuring 9/32" (0.281") outside diameter. Miscellaneous sizes of brass tubing and assorted shapes are available in many hardware stores and model shops. These are typically stocked in 12-inch lengths. Where longer pieces are required, buy two 12-inch lengths for each converter and slip a 4-inch length of the next smaller size inside, then solder them together. Be sure the assembly is straight.

•Coaxial Connector: You can get away with using the UHF type (SO-239) connector at 2 meters, although it is not ideal. At any higher frequency, always use high quality Teflon™ and silver N connectors, normally designated UG-58/U. These connectors cost $3–5 each new, but if you are going to go to the trouble of building equipment for these bands, it is false economy to use cheap connectors. Also, stay away from the inexpensive bright nickel plated ones, as they will corrode, and usually do not have insulators capable of tolerating the soldering heat required for assembling these impedance converters. It's depressing to watch the center melt and drop out of a connector as you attempt to solder the flange.

Good used UG-58s are widely available at hamfests and surplus outlets. A good cleaning in the dishwasher and the use of a used (soft) Scotch-Brite™ cleaning pad does wonders. Stay away from cleaning with steel wool, as you'll leave brass where silver used to be! Also, steel wool has the bad habit of leaving little electrically-conductive strands in the least noticeable places.

•Center Contact: Since the center conductor of the CATV hardline is copper-coated aluminum, you will need some form of finger connector for positive contact. The most elegant solution I have seen was published by Bill Olson W3HQT in his ">50" column for *QEX* magazine in March, 1988. Bill used the double female center pin removed from a UHF "T" connector, cut in half to provide two sets of fingers for two impedance converters that just fit the hardline center conductor.

•Miscellaneous:

Silver hobby solder. This is a high-strength, low-temperature solder available at most hardware and hobby stores. Silver solder resists corrosion in outdoor service, and is reputed to provide better conductivity to RF than its ordinary lead-tin relative. It has separate solder and flux.

Hose clamps. Use stainless steel, screw types. One for each impedance converter.

Hand tools. Include a tubing cutter, hacksaw, small triangular file, and small steel square for alignment. Also, a small pencil torch is much easier to use than a regular propane torch.

No Al Ox™, or similar compound for preventing corrosion between the aluminum outer jacket of the hardline and the copper impedance converter. Available at electrical supply houses.

A **soldering and assembly fixture**, made by drilling an 11/16-inch hole, ¾ inch deep in a wood board. Not absolutely necessary, but sure beats trying to hold a hot connector in your fingers.

Parts Preparation

•Center Contacts:

Disassemble the UHF T connector by grasping the male connector center pin with vise grips and unscrewing it counterclockwise. Drive the double female center conductor out of the end of the connector. Note that some T connectors have a slight crimp on one end, so gently drive the pin out the opposite end. Discard all pieces except the double female pin. Saw the double female in half to make two center contacts, one for each end of your hardline system.

Fit the end of the contact opposite the fingers to the 9/32 center conductor tube. It may well be a perfect, tight fit. If not, turn the outside diameter of the solid end to fit the 9/32 tube tightly. It is best to use a lathe, but you can do a satisfactory job by chucking the pin in the chuck of a drill clamped in a vise and "turning" it with a file. When clamping the contact in the drill chuck, slide it in far enough for the jaws to contact the solid part, not the fingers. Be careful. Turning down a 1/16 to ⅛-inch length is adequate since the contact and the center tube conductor will be soldered together. Set the prepared pins aside for later assembly.

•Center Conductor:

One end of the 9/32-inch tube center conductor must be necked down to the ⅛ inch diameter of the solder pin on the UG-58. Do this before you cut the tube to length, so that if you goof, you can cut the end off and try again.

First, clean the tube and insure that one end is square. Scribe a mark around the tube 3/32 inch from the end. Then, cut eight equally spaced slots in the end of the tube to the 3/32 line. With the small triangular file, file each slot slightly to create eight equal fingers that each taper to about 1/16 inch at the outer ends. Remove all burrs. Gently bend each finger inward a little at a time until you have a ⅛-inch hole in the center. Be patient. Check the fit on the center pin of the UG-58. When you are satisfied, clean and tin the end lightly with the silver solder and flux.

Now assemble the UG-58 and the center conductor. Place the connector, threaded end down, into the hole in the "assembly fixture." Tin the connector pin. Heat the necked-down end of the center conductor and slip it over the connector pin, then solder the two together. While the joint is still hot, use the steel square to insure that the center conductor is perpendicular to the flange of the connector in all planes. Hold the piece until it cools.

Next, lay the previously-prepared center contact pin next to the soldered center conductor and connector assembly. Measuring from the insulator on the UG-58 out to the end of the center contact pin fingers, set the overall length to that required by the frequency of interest. Mark the center conductor tube so that, when cut and pressed together with the center contact pin, it will be the right length. Cut the 9/32 tube. Clean and deburr the end. Put some flux on it and press the center pin into the end of the tube. Recheck the overall length, then solder. Remove all traces of flux with alcohol.

•Outer Conductor:

Standard ¾-inch copper pipe with its 0.032" wall is almost exactly 0.065" larger than the outside diameter of the jacket on the ¾-inch hardline. So, we need to prepare a spacer sleeve to match the two diameters. First, square one end of a piece of copper pipe, then clean and deburr it. Now, with a tubing cutter, cut off a 1-inch long section. This length will be the spacer sleeve. Now mark and saw a ¼-inch wide section lengthwise from the side of this sleeve. Deburr the cut, then compress the sleeve evenly until it will just start into the end of the uncut copper pipe.

Clean the uncut outer conductor and remove the ridge left by the tubing cutter from the inside end. Slot the end of the pipe in 4 places, to ½ inch from the end of the tube. Deburr.

Cut the outer conductor to length with the tubing cutter as specified in Table 1 for the band desired.

Frequency (MHz)	Length of center conductor. (inches)	Length of outer shell (inches)
144	20.5	21⅜
432	6.83	8
902	3.27	4⅜
1296	2.27	3⅜

Table 1.

•Final Assembly:

Stand the previously-prepared center section on end in the hole in the "assembly fixture." You will soon be glad that you made this fixture. Lightly flux the flange of the UG-58 and the unslotted end of the outer conductor. Stand the outer conductor on the flange and center it. Look in the opposite end of the assembly and insure that the center contact pin is well aligned in the center of the outer conductor. If not, this is your last chance to fix it. When alignment is correct, heat the outer conductor and flange until the flux bubbles, then touch the solder to the surfaces. When the heat is right, the solder will flow between the parts. Use enough solder to get a strong, complete bond between the parts. Do not disturb the assembly until it cools. Then, clean all flux away with alcohol. The converters are now complete and ready for assembly to the hardline.

Hardline Preparation

Completely install the hardline without the impedance converters. Keep any bends as large as possible. To avoid kinking the line, I have found it helpful to cut radius forms from wood, and then bend the line over them. A 10-inch radius seems adequate.

Cut the hardline with a hacksaw. Then score the aluminum outside jacket with the tubing cutter back ½ inch from the end. Grasp the end of the hardline jacket with pliers and rock it gently to break the jacket at the score. Remove the end section of the jacket. Cut through the foam insulation to the center conductor with a sharp knife, flush with the end of the outer jacket. Do not nick the center conductor. Twist and pull off the section of insulation, then scrape the center conductor clean but do not damage the copper coating. Trim the end of the center conductor to protrude ⅜ inch beyond the foam insulation. Round the end with a file.

Clean the outside of the aluminum jacket with a Scotch Brite pad and alcohol. Since copper and aluminum clamped together are subject to galvanic corrosion (and aluminum oxide is a dandy insulator), lightly coat the newly cleaned aluminum surface with No Al Ox.

Assembly

Start the split copper spacer sleeve into the slotted end of the impedance converter outer conductor. Slide the impedance converter over the prepared hardline, insuring that the hardline center conductor enters the center contact pin. Slide them together as far as possible. The end of the contact pin should butt against the hardline dielectric. Then tap the spacer sleeve between the two surfaces until it is flush with the slotted end of the outer conductor. Secure with a hose clamp. That's all it takes! Be sure to waterproof the assembly for outdoor use.

Performance

While I lack access to the equipment required to accurately measure return loss, experiments with a directional coupler indicate no perceptible difference in SWR whether the measurement is taken at the input or output end of an assembly of two impedance converters and 50 feet of 75Ω CATV hardline. In practice, they work great. I use this arrangement on 144, 432 and 1296 MHz. On 23 cm, the bandwidth is broad enough to make no performance difference between use on 1296 terrestrial and 1269 satellite. And the reduction in line loss on Mode L satellite uplink is so dramatic that it has made a signal that was, with 13 Watts into 50 feet of Belden 9913, barely readable on SSB, to a quite satisfactory signal.

This simple project is bound to save you many dollars on low-loss transmission line cable. Good luck! 73

73 Review *by Ron Hranac NØIVN, Doug Greene NQ9I, and Bill Brown WB8ELK*

AEA FSTV-430

The latest entry into the 70cm ATV transceiver market.

Advanced Electronics Applications, Inc.
PO Box C-2160
Lynnwood, WA 98036
PH: (206) 775–7373
Price Class: $500

Fast-scan amateur television (ATV) is a fascinating mode of ham radio. ATV is much like commercial TV—images are displayed at 30 frames per second, resulting in video that constantly and fluidly changes to the human eye. Compare this to slow-scan TV (SSTV), in which images are displayed only once every 8–9 seconds.

Video images are "information rich," and so it takes a large signal bandwidth to send frames of video at an appreciable rate. That's why you find ATV only in the UHF and above bands—it's only in these regions where you are allowed signals with the required bandwidths for ATV.

A very popular band for ATV is 70cm. This review addresses a new ATV transceiver on the market for this band, the AEA FSTV-430.

Panel Controls and Ports

The AEA is housed in a well-shielded and attractive case and has front panel controls for adjusting video and audio gain. You can plug the AEA into your TV camera with a 10-pin front panel connector, and switch video sources, between TV camera, VCR, and computer. To conserve power, you can also switch the camera off when you're using other video sources.

Crystal and VFO

You can order this transceiver with one or two of the popular ATV frequencies (434, 439.25, 426.25, 421.25 MHz). It produces the final signal by generating a Channel 3 or Channel 4 TV IF frequency, and then upconverting by mixing this with a crystal controlled local oscillator (LO). The same LO and mixer circuitry receives ATV. As a result, the two selected frequencies are crystal controlled also on receive. As long as the other station is on one of these same frequencies, no tuning is necessary.

A favorable feature of the FSTV 430, however, is that it also includes a variable tuning control for the entire ATV band. A switch disables the crystal controlled local oscillator and enables the VFO.

The receive IF frequency can be either Channel 3 or 4 on your TV, depending on whether there's a strong commercial station nearby. Changing the IF involves installing new crystals and moving two jumpers. The transmitted signal, basically the output of the Channel 3 or 4 modulator before upconversion, can be monitored directly on Channel 3 or 4. Although it's better to actually sample the final output as long as the output stages are linear, this will still give you a good indication of your transmitted signal.

Photo A. Front panel of the AEA FSTV-430.

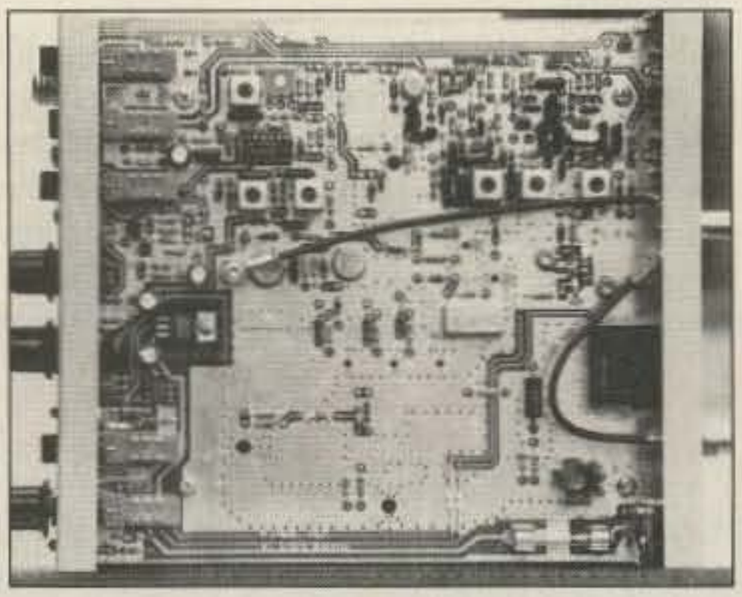


Photo B. Top of the PC board of the AEA FSTV-430. Layout is very neat.

". . . the FSTV 430 . . . also includes a variable tuning control for the entire ATV band."

This rig has a built-in vestigial sideband filter, which rolls off the lower sideband of the transmitted signal 1.25 MHz below the video carrier. It eliminates emissions below the band edge on 421.25 MHz, and weak signal or satellite bands on the other frequencies. (See sidebar for discussion of vestigial sideband.)

Operation

When we made several on-the-air mobile ATV tests, most stations commented on the excellent quality of the picture. Several stations mentioned that even with a weak (P2–P3) signal, they heard a good sound subcarrier, even though the audio gain was a little lower than some of the other rigs on the market. One factor to consider when operating mobile or with battery packs, is that a rig's performance drops off considerably below 12 volts. Also the current drain of 300 mA on receive and 700 mA on transmit will mean that the battery pack should be selected accordingly, and preferably have an extra cell for 13.8 volt operation.

Receiver Performance

[Ron NØIVN performed the following measurements . .Ed]

The FSTV-430 uses a low noise front end. Received 70 cm ATV signals are amplified and routed to a diplexer that is part of the transmit/receive IF stage (see Figure 1). The signals are then amplified and applied to a mixer for downconversion to IF. After additional amplification, a second diplexer routes the IF (Channel 3 or 4) to a vestigial sideband SAW filter. This filtered channel is available at the rear panel TV F connector for display on a conventional television set.

I measured the downconversion gain vs. noise figure at the FSTV-430's TV output at four different settings: receiver tune at crystal control position, and receiver tune at low end, midrange, and high end of the VFO range. Downconversion gain ranged from 10.5 (VFO high end) to 12.3 dB (crystal setting), and receiver noise runs 2.2 (crystal setting) to 2.8 dB (VFO high end). All observations here were taken at the video carrier frequency.

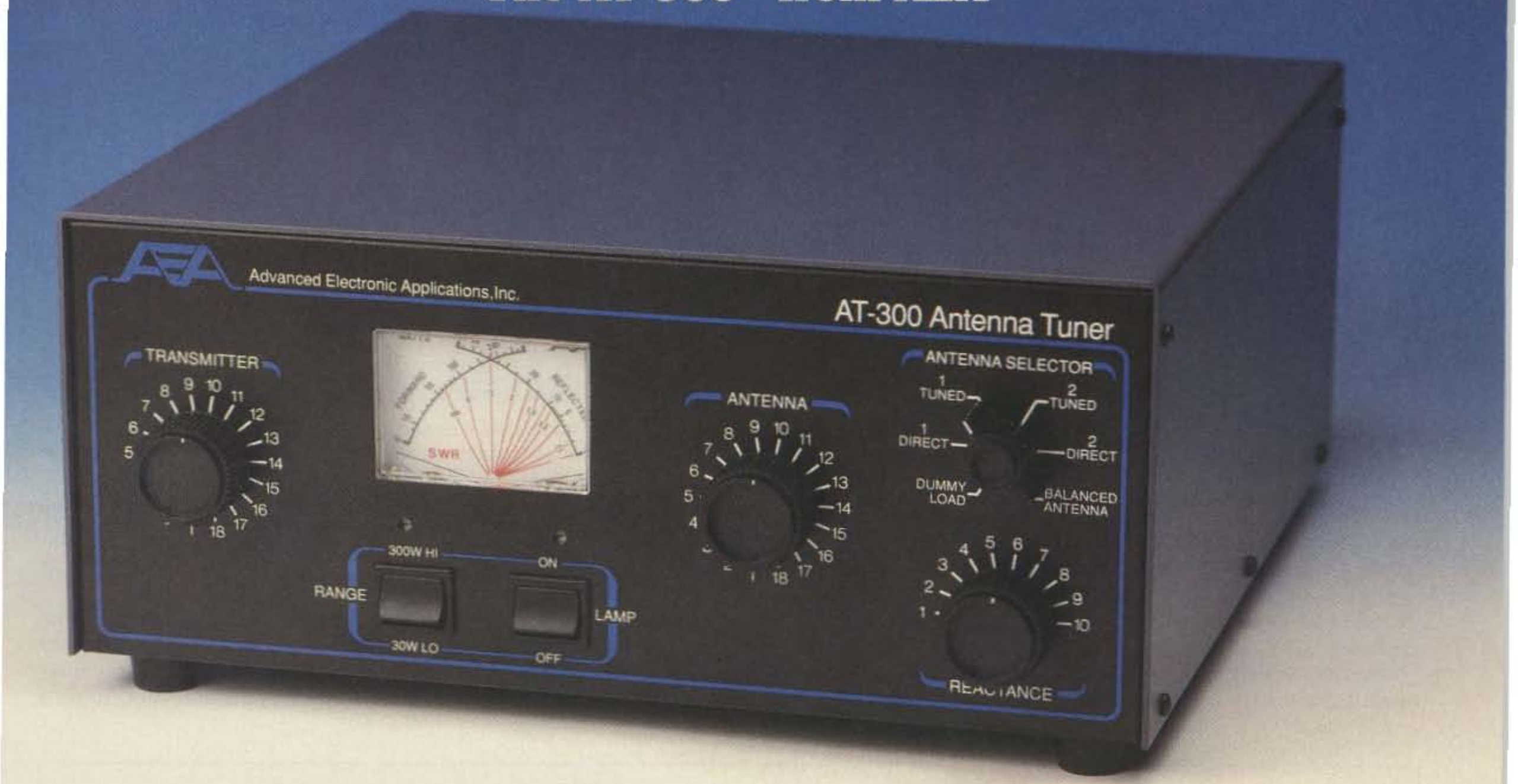
Downconverted frequency accuracy was quite good: a 434.000 MHz input signal produced a Channel 3 output at 61.2527 MHz.

Most television sets will have excellent picture quality with a 1,000 microvolt RF input. The AEA transceiver will provide that signal level at its TV connector with a received RF input of about 225 microvolts; signals above

AT-300™ Antenna Tuner

An affordable antenna tuner from a name you can trust

The AT-300™ from AEA



Low Pass Design

The low-pass design of the AT-300 is what you would expect from a company where Engineering Makes the Difference. The low-pass design of this AEA tuner means harmonic attenuation for lower TVI potential. This design also allows matching a much wider range of antenna impedances than the common high-pass designs.

Larger Size

One look at the AT-300 lets you know this tuner is different, it's bigger. While some manufacturers promote the small size of their tuners, AEA knows that performance is most important. The simple reason for the larger size is that smaller sizes degrade the inductors' Q (Quality factor), which results in less efficiency. Less efficiency means that for a given power output from your transmitter, less power will actually get to your antenna.

Easy Operation

The AT-300 tuner features a precision frequency compensated dual- movement SWR meter for ease of tuning. The high and low power front panel switch selects the proper range for the SWR meter. The AT-300 is rated for 300 watt operation. The internal balun and front panel selector switch allows for balanced and unbalanced outputs.

Get maximum performance from your transceiver and antenna by using the AT-300 antenna tuner from AEA. See your local AEA dealer today or contact:

Advanced Electronic Applications, Inc.
P.O. Box C-2160
Lynnwood, WA 98036
206-775-7373

AEA Retail $249.95
Amateur Net $219.95

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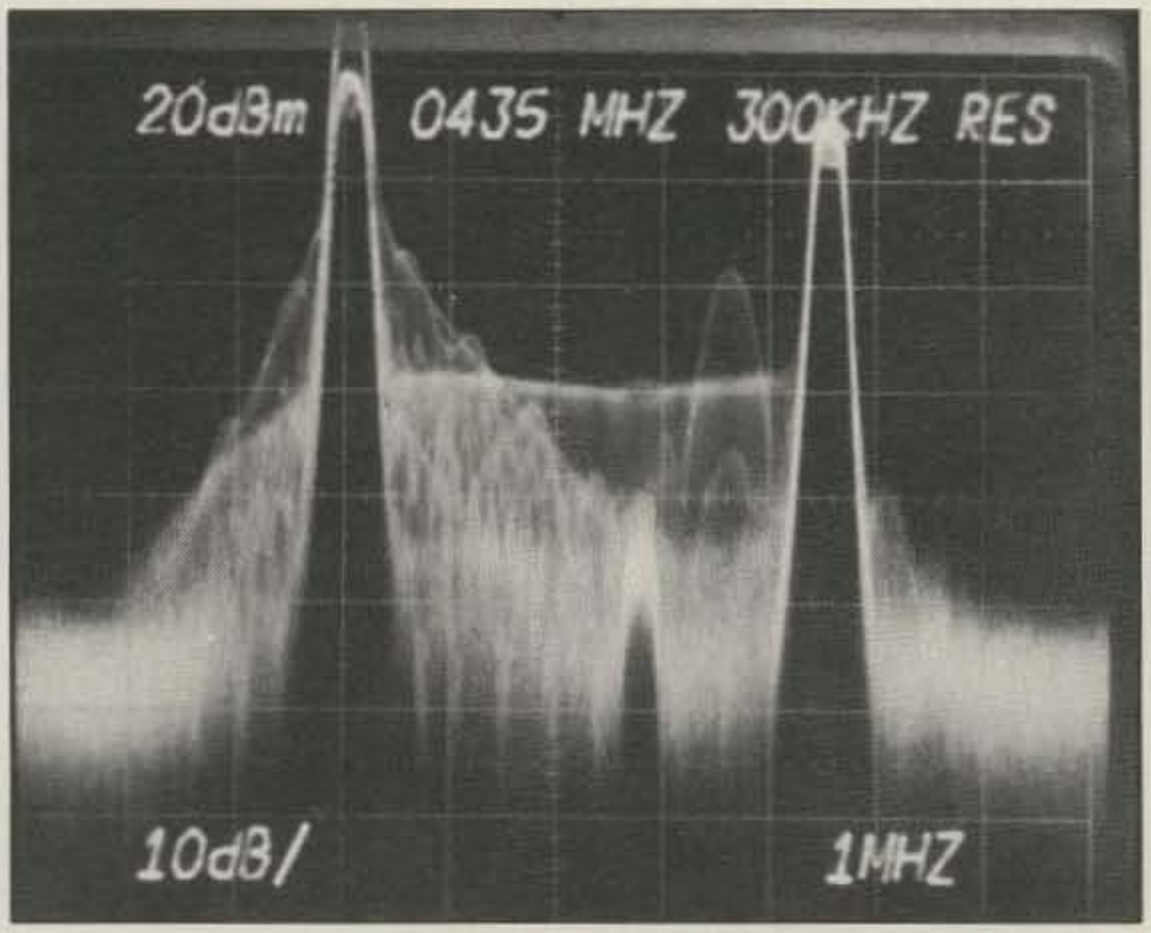

Photo C. In-channel frequency response of transmitted signal.

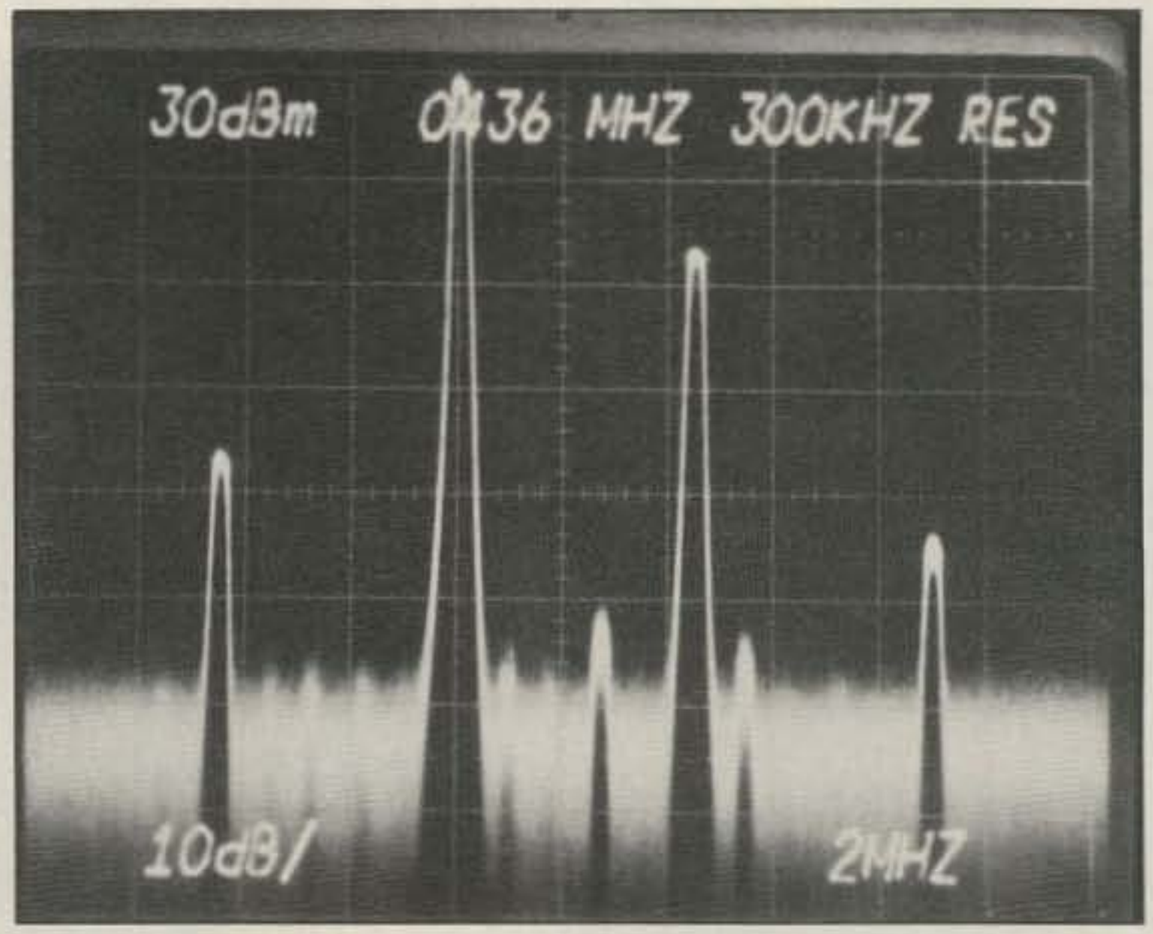

Photo D. Unmodulated transmitter output. The vertical scale is 10 dB/division; the horizontal scale is 2 MHz/division. The video carrier is at full vertical scale. The audio carrier is 4.5 MHz up from the video carrier, and is about 17 dB below the video carrier. The other peaks are spurious outputs.

about 2,800 microvolts will begin to overload the FSTV-430's front end. The minimum signal necessary to produce 40 dB video signal-to-noise is 147 microvolts; picture quality at that point is roughly equal to a standard VHS videotape.

Receiver current draw at 13.8 volts was measured at 0.30 amps.

Transmitter Performance

The transmitter's video input signal, from either the front panel 10-pin CAMERA connector or the rear panel VIDEO IN connector, is amplified and its sync pulses expanded before modulation (Figure 1). The audio input signal is also amplified, then the two are combined in the modulator stage. At this point, the video signal becomes an amplitude modulated IF at either Channel 3

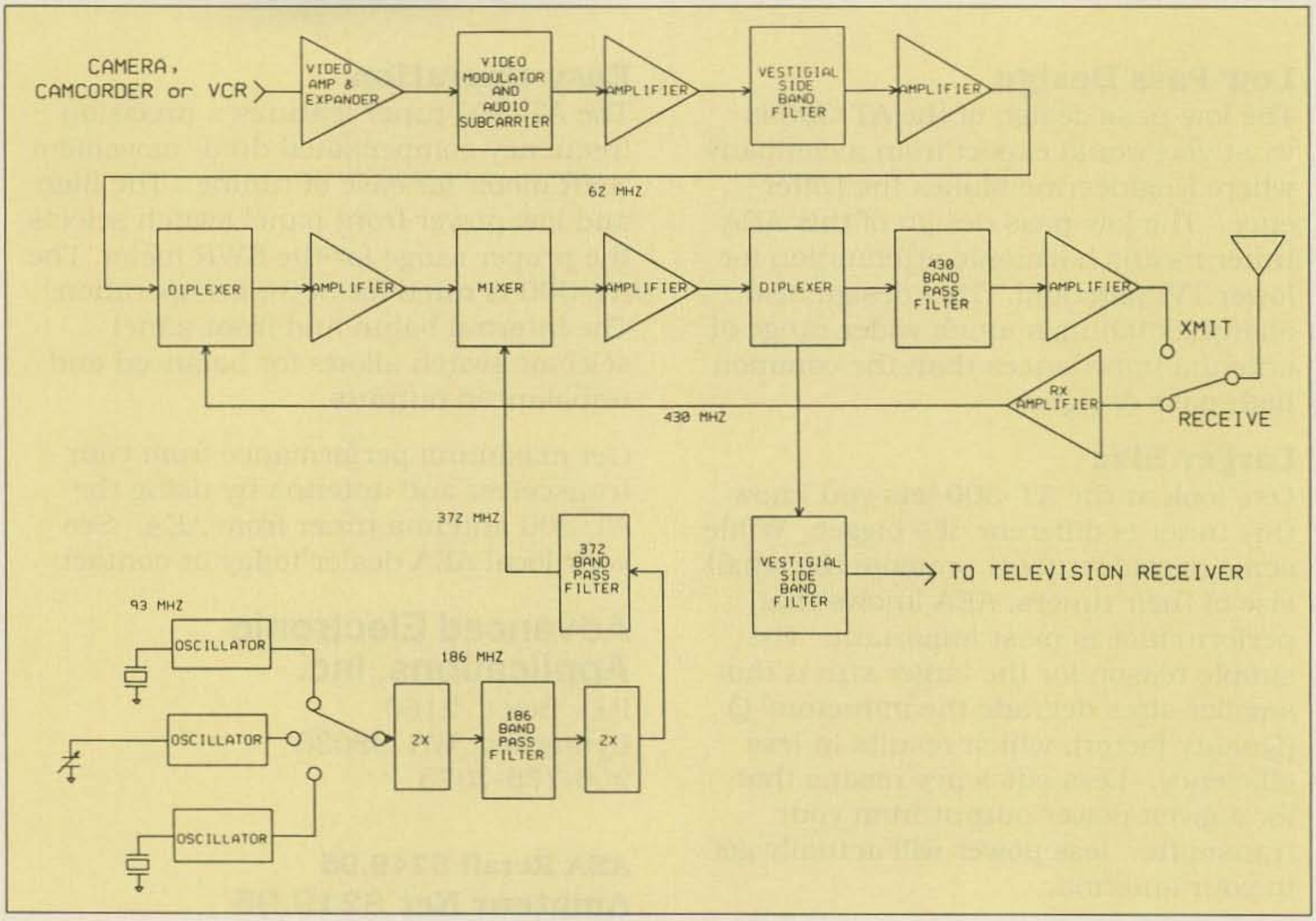

Figure 1. AEA FSTV-430 block diagram.

(61.25 MHz) or Channel 4 (67.25 MHz); the audio signal frequency modulates a subcarrier located 4.5 MHz above the user-selected IF video carrier.

The IF is upconverted to the desired 70 cm ATV frequency (434 MHz standard) and amplified to 1 Watt. The transmitter IF also is available at the transceiver's rear panel F connector for monitoring on a conventional television set.

Transmitter video carrier output power with no modulation present was measured at +31 dBm (1.26 Watts); with 1 volt peak-to-peak video input and the video gain control set at maximum (75% depth of modulation), the output power at sync tips increased 1 dB to 1.58 Watts. At this output level, the audio carrier was 18 dB below the video carrier. Curiously, after a few minutes of operation, the transmitter's output power dropped to +29 dBm (0.79 Watts). Paralleling this decrease in output power was an increase in the transceiver's operating current, from 0.72 amps when the transmitter was first turned on to 1.01 amps after several minutes of operation.

In-channel video frequency response was ±1 dB (Photo C) at 75% depth of modulation. Although the FSTV-430 uses vestigial sideband filtering in the IF, output amplifier nonlinearities introduce some third order distortions that appear as spurious signals 4.5 MHz below the video carrier and 4.5 MHz above the audio carrier. These signals were 34 dB and 43 dB below the video carrier respectively (Photo D). There also was an in-channel spurious signal 2.75 MHz above the video carrier at −53 dBc, and another 1 MHz above the audio carrier at −56 dBc. The worst case out-of-channel spurious was the transmitter's second harmonic, which was −29 dBc. The mixer LO signal was −35 dBc (372.75 MHz) at the

Why Vestigial Sideband?

A vestigial sideband (VSB) transmission is a signal type that falls somewhere between single sideband and double sideband, in which one sideband and a vestige (small part) of the other sideband are transmitted. This scheme was proposed in 1938 for commercial television broadcasting, so that a 4 MHz video bandwidth could be transmitted in a 6 MHz wide channel. Technically, the vestigial sideband of an over-the-air broadcast TV channel is what is left after filtering out most of the lower sidebands generated in normal double sideband amplitude modulation.

But why not just transmit TV pictures with plain old single sideband, if the goal is to use less RF spectrum? Unfortunately, the complex video signal transmitted by broadcasters is such that a type of picture impairment known as quadrature distortion results if at least some of the lower sideband does not accompany the full upper sideband. Fortunately, it was determined early in broadcasting that the sidebands more than about 0.75 MHz from the video carrier were small enough to allow removing some of the lower sidebands. This still results in another problem—group delay—but this is not nearly as bad as the quadrature distortion that would occur if true single sideband transmission were used.

The benefit of VSB to radio amateurs transmitting fast scan video is reduced bandwidth. In fact, a true VSB signal with a 4.5 MHz audio subcarrier will occupy only 6 MHz, the same as over-the-air broadcast TV. Double sideband could be as much as twice that! VSB benefits are quickly lost, though, if fast scan power amplifier stages are not extremely linear. The presence of the video carrier and its 4.5 MHz sound subcarrier in an amplifier circuit can generate third order intermodulation products, which appear as if new sidebands have been created in the amplifier. These "regenerated sidebands" actually are distortions that fall at twice the video carrier frequency minus the audio subcarrier frequency (2V − A), and twice the audio subcarrier frequency minus the video carrier frequency (2A − V). This is why broadcasters use separate video and audio transmitters, and passively combine the signals in a diplexer prior to the transmission line and antenna.

. . . de N0IVN

transmitter output. All other spurious signals were at least 50 dB down.

Another indication of in-channel frequency response is the demodulated multiburst test signal shown in Figure 2. The demodulated composite test signal in Figure 3 provides a visual indication of short time and line time video distortions, which are related to picture detail and sharpness. That test signal is also used to measure chrominance-to-luminance delay and gain, as well as differential phase and gain. This data is useful for determining how well color video will be transmitted. For a summary of that information, see the table.

How's The Image?

Though the transmitted pictures aren't broadcast quality, they do look quite good. In fact, under P5 conditions, and with identical video sources, you would be hard pressed to tell the difference between an ATV signal from the FSTV-430, and one from your local television broadcast station.

"... under P5 conditions, and with identical video sources, you would be hard pressed to tell the difference between an ATV signal from the FSTV-430, and one from your local television broadcast station."

General Comments

The physical appearance, circuit layout, and mechanical design of the transceiver are very good. The ability to monitor transmitted and received video on a conventional television set tuned to the rig's IF (Channel 3 or 4) is a handy feature, and with its compact size (2.6" x 7.4" x 8.3"), it won't take up much room in the shack or out in the field. Power consumption is a bit on the high side for extended continuous operation with batteries, especially if a camera will be powered from the front panel 10-pin connector, but with an external supply, this shouldn't be a problem. The antenna connector is a BNC type; I prefer a type N connector for 70 cm operation.

The FSTV-430 manual is well-written and very complete. It includes a good block diagram and schematic, along with operating instructions and theory of operation. The only thing missing from the manual is information on alignment.

We had an opportunity to use the transceiver during the Denver area's weekly ATV activity night. Other hams receiving the FSTV-430's signal commented on its good audio quality, and judged its performance very good, too. The in-channel spurious signal 2.75 MHz above video did produce a very slight beat pattern in the picture, but it was not objectionable (this appeared after about a half hour of operation, and did not go away). We tested a prototype of the FSTV-430 a few months ago, and it did not have the in-band spurious problem. This is probably a bug unique to this particular transceiver. All in all, a nice rig! 73

FSTV-430 Video Performance

Line Time Distortion	1.1%
Pulse/Bar Ratio	118.1%
2T Pulse K-Factor	2.7% Kf
Chrominance-Luminance Delay	191.0 nanoseconds
Chrominance-Luminance Gain	148.5%
Differential Gain	15.5%
Differential Phase	9.5 degrees

Table 1.

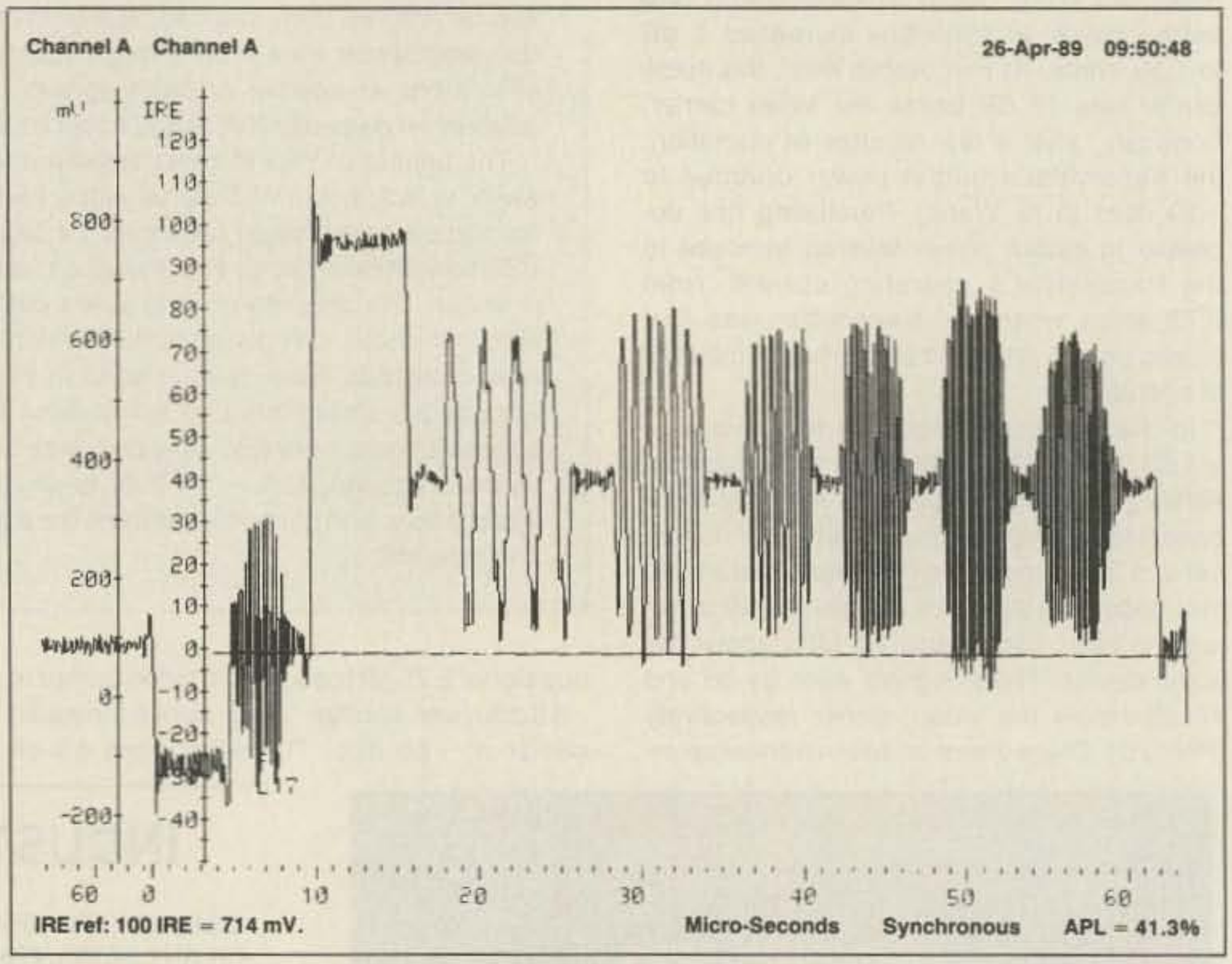

Figure 2. Demodulated multiburst test signal.

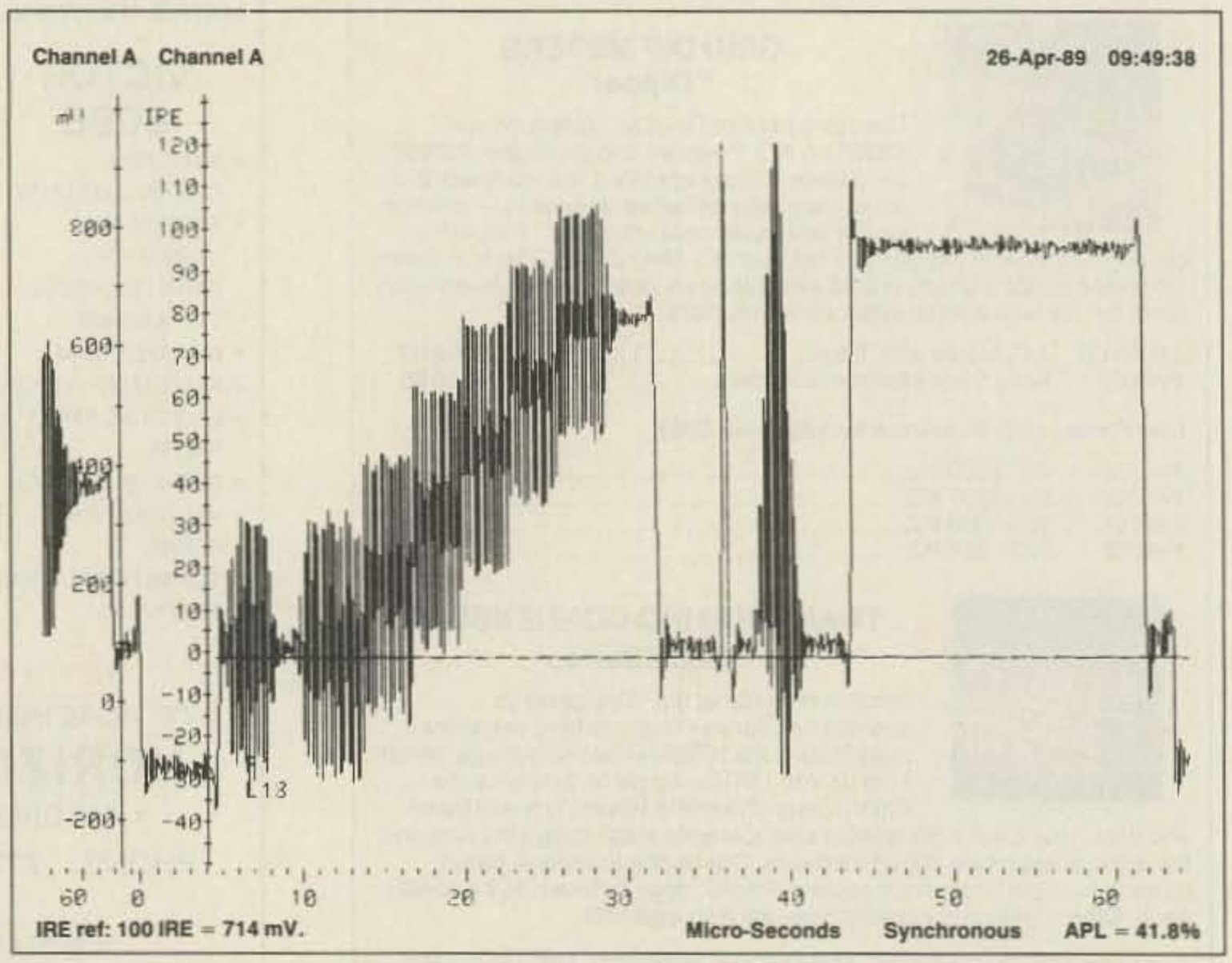

Figure 3. Demodulated composite test signal.

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- **TA451 for uhf.**
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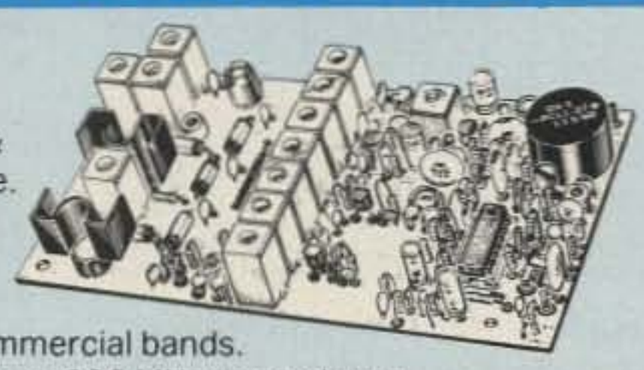

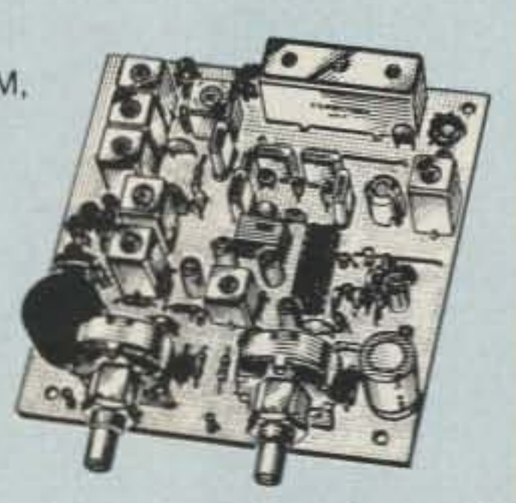

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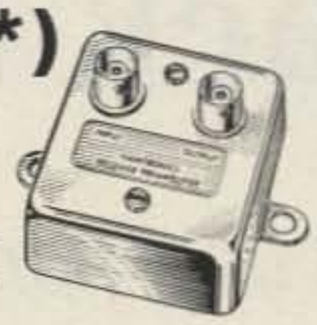

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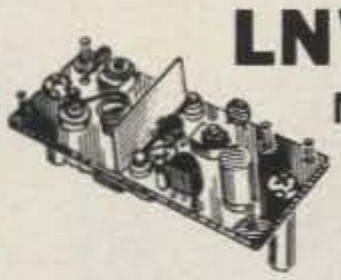

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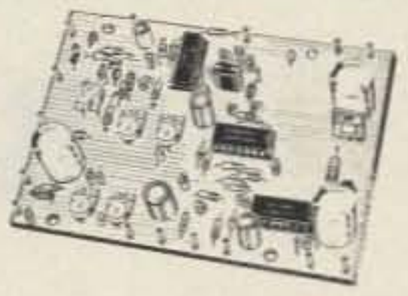

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50-52	28-30
50-54	144-148
136-138	28-30
144-146	28-30
145-147	28-30
146-148	28-30
220-222	28-30
220-224	50-54
222-224	28-30
432-434	28-30
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432-436	50-54
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"Black Bag" Portable

Set up a portable QRP OSCAR station.

by Tom Hall N6DGK

There's been a lot of talk lately about working satellites with HTs, especially with the possibility of a Phase IV geosynchronous system in the future. Some amateurs have already experienced this by using one of the few gateway stations that operate through AO-10 and AO-13.

A gateway is basically a repeater linked to an OSCAR station, an exciting application of modern amateur technology, but not available to everyone. It is possible, though, to operate through LEO (low earth orbit) satellites with small low powered radios and simple vertical antennas. I've been doing this for some time using Mode A and operating through RS 11. The entire setup fits into a small black shoulder bag I call the "Black Bag Portable."

The heart of this system is AEA's new 10m Handy, and the older Yaesu FT290R, which is the radio recently used by cosmonauts U1MIR and U2MIR. The other parts of the setup are a 10m GaAsFET preamp and a telescoping groundplane mount for the 10m antenna. The FT290R is ready to go, using the internal telescoping antenna and 2 Watts. The 10m Handy, however, requires a search for crystals to put its two-channel VXO in the 29.5 MHz range. AEA does not have crystals for any frequencies above 29 MHz and does not guarantee performance above 28.6 MHz. The manual does infer that a factory retune is possible, but that pF course means that the low end performance would be lost. I decided to use the GaAsFET preamp to compensate for the lack of sensitivity in the satellite subband, hoping that the VXO would work at those frequencies.

Photo A. Complete Mode-A station. It includes the FT-290 with telescoping antenna, the 10m DX handy, antenna stand with coax, and 10m GaAsFET preamp (with 9V battery and coax).

Adding Crystals and Preamp

AEA provides 2 crystals, one which sets the range of the VXO from 28.250 to 28.30 and one for 28.30 to 28.350 MHz. I tackled the crystal problem with a call to Jan Crystals [P.O. Box 06017, Ft. Myers FL 33906, (813) 936-2397]. I've used them before as a source for "rock-bound" radios that I still have. Their service is good and the prices are reasonable. I asked them if they could make crystals for the frequencies I needed if I sent along one of the crystals I already had. They assured me it was no problem, so I sent one along with my order.

During the wait for the crystals, I ordered and built a GaAsFET preamp to make up for sensitivity lost at 29.5 MHz. This was a Hamtronics, Inc. [65 Moul Road, Hilton NY 14468-9535, (716) 392-9430] Model LNW-28. These preamp kits are a great value at only $24. They have other models that work all the way up to 500 MHz.

Also during the wait I ordered crystals from AEA to make the Handy work with the Hamtronics 435 downconverter in the mobile mode J station. That arrived ahead of the Jan crystals so, during the next mode JA pass of FO-12, I gave it a try.

The bottom end of FO-12's pass band is 435.8 MHz. The Hamtronics CA432-5, which is the one I am using, converts to 28.8 MHz. Since this is beyond the range of AEA's specs, I had some indication of what the performance would be like at 29.5 MHz. As it turned out, even with the Hamtronics 435 GaAsFET preamp I was using and the gain of the down converter itself, I could just barely make out FO-12's beacon. The DX Handy's volume control was all the way open. It definitely needed front end or IF gain, so I installed the LNW-28 preamp. The difference was dramatic! I now had more sound from the speaker than I needed and plenty of movement from the Handy's S-meter.

Photo B. Some Mode-A RS 11 operation from the Grand Canyon. The author just finished a contact with WA7NQQ in Oregon, TCA elevation was about 30° to the west. His report was S-5.

Operation at Home and on the Road

Finally the crystals arrived and I was ready for Mode A and RS 11. My first try was done

in the back yard using camera tripods for antenna mounts, the DX Handy's telescoping antenna, an AEA half-wave portable antenna for 2m, and of course the LNW-28 preamp. The entire setup worked better than I anticipated. RS 11's beacon was strong, tuning the passband was not too difficult, and my uplink was coming through loud and clear. I only made one contact on this occasion—KA0SHC in Kansas. His signal was S-9, very strong and easy to copy. He returned an S-5 signal report for the signal coming from the FT290R.

"The heart of this system is AEA's new 10m Handy, and the older Yaesu FT290R."

Since then I've used the portable many times in some rather unusual circumstances. I made contact with KA4BLN in Alabama while on a tour at Griffith Observatory in Hollywood CA, talked to WA7NQQ in Oregon from the south rim of the Grand Canyon, and worked WW6J from the Disneyland Hotel while attending Hamcon '88. I've also made two brief contacts with WB6LLO in San Diego through FO-12, with the addition of the CA435-2 downconverter and a small 432 yagi, still using just the FT290R and its telescoping vertical with 2 Watts of uplink power.

The "Black Bag Portable" is proof that amateur satellite ground stations need not be complicated or expensive. Operating portable does have its limitations, of course, but I've found a couple of tricks to make it work. Holding the FT290R in one hand while transmitting and rotating it in the air for strongest downlink keeps fading at a minimum. As the satellite passes, it slowing spins on its axis so rotating the 2 meter antenna keeps the polarity sense the same between satellite and ground. Mounting the 10 meter antenna at a 30 degree tilt from vertical and rotating it in a 360 degree circle has the same effect.

One precaution: I've also discovered that laying the 10 meter preamp along side the Handy can produce RF feedback and cause the receiver to go into oscillation. Always keep it at the top end of the radio!

For those who are interested in going portable, good luck. You're in for some real fun! 73

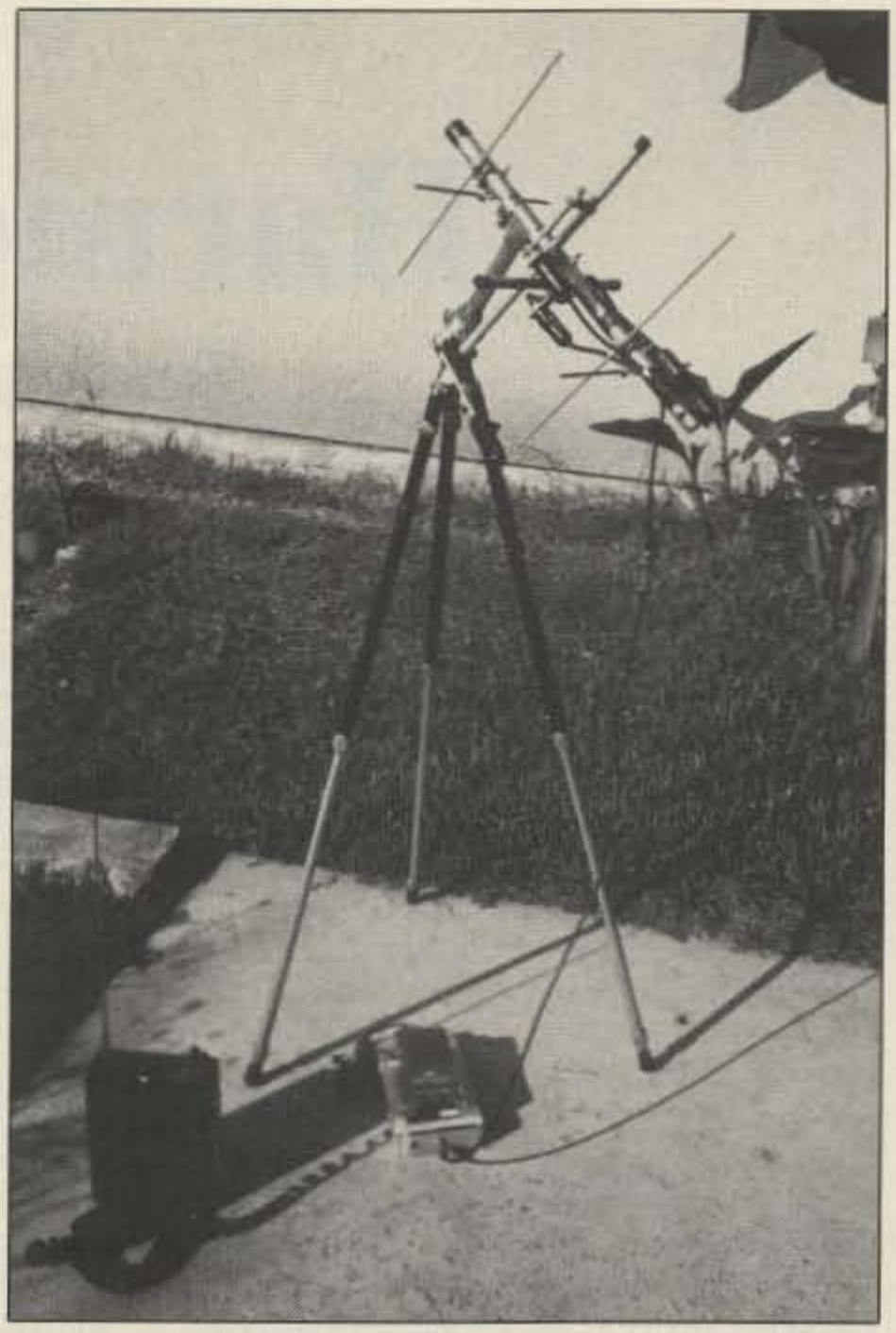

Photo C. A little FO-12 operation anyone? The author worked WB6LLO on Mode-J in two passes with three Watts on the 2m uplink.

Harmonic History

Thirty years of suspense. . .

by Elizabeth O'Connell

Thank goodness for television reruns. It took nearly 30 years, but I finally discovered how the Lone Ranger and Tonto escaped Miles Murdoch's deserted mine shaft. I was so excited, I immediately telephoned my sister.

"November 1955," I yelled. "Remember? The mine had just collapsed, Murdoch was rubbing his hands together with a sinister smile on his face, and Silver was reared up behind him, snorting."

"Yes, yes," my sister said, her own excitement mounting. "You found out what happened, didn't you? Don't make me wait," she demanded. "Tell me!"

Of course, I told her instantly. It had been the same anxious, suspenseful 30 years for her. After all, we had been harmonics together. Yes, harmonics. Most little girls are sisters, siblings, or daughters, but when your dad is a ham radio operator, you're a harmonic. Technically, in ham jargon, harmonic means an off-shoot of a principal signal that appears on a different frequency. Pretty clever.

Growing Up as a Harmonic

In the 1950s when Dad was on the air, we harmonics never saw nor heard a complete half hour of the Lone Ranger without the interference of Dad's mighty transmitter/receiver in the basement. The RFI went straight through the wall to the TV set in the living room, leaving our black and white heroes in static limbo. Those were the good old days before the refinement of amateur radio equipment, and eons before cable TV screened out all sorts of interference.

Now there's a carpet on the living room floor, which I suspect our mother put there to cover up a worn spot by the television where little fists pounded the floor and little girls hollered, "Dad, you're making interference!"

Subliminal Learning

The heat register in our bedroom, a great sound conductor, was located directly above Dad's radio. As my sister and I slept, mysterious codes floated up through the duct work, bearing subliminal messages.

CQ, CQ 40. This is W3TUG, W3 Tear-Uncle-George. Does anybody read me?

Translation: My dad, Mike, whose call letters are W3TUG, was on the air. Was anybody out there? Did anyone hear him and want to talk?

Through osmosis, we learned a great deal. We knew that Mom was his XYL—his married young lady. QSL cards were postcards hams sent to each other confirming their contact on the air. "Over" is what Dad said when he was finished talking and it was the other guy's turn. "73" meant good wishes, best regards.

Sometimes Dad let us say a few words into his microphone. We never said much, just harmonic gibberish. But once, Dotti spoke to a ham in England and asked him to send her a leaf from a tree in Robin Hood's Sherwood Forest. The gentleman was obliging, as we discovered most ham operators are, and mailed her the leaf. I imagine she was a big hit at Show and Tell, and I know she still has the leaf.

"I believe he met his best company in 1970 when he became a member of the International Handicappers' Net."

A Normal Part of Life

Ham radio was an integral part of our lives. I suppose it couldn't have been any other way. Dad has been involved with amateur radio since 1929. While in the Navy during the Second World War, he operated and maintained radio equipment. In fact, it was through his radio that he came to meet our mother. It was during the latter part of the war when he made contact with a young soldier over the air. Since both were on leave and lived near one another, Dad accepted an invitation to his home. Keeping in step with the high romance of the war years, the young soldier introduced him to his beautiful sister, Dorothy. She soon became W3TUG's XYL.

We've all moved on with our lives since then. My sister and her family are in Arizona, and my husband, son, and I live in Florida. Mom and Dad are still in Pennsylvania, but conditions are quite different now. Mom can relax in her recliner without worrying about interference from the basement.

Good Company

And Dad, although he doesn't jet around much, is far from stationary. Every day, his radio takes him all over the country and, indeed, the world. He's spoken to people in each of the European nations, including the Soviet Union. The air waves have taken him to the Kingdom of Nepal, South America, Christmas Island, Granada, and even the South Pole. His hobby keeps him in good company, such as Barry Goldwater K7UGA and King Hussein of Jordan JY1.

But I believe he met his best company in 1970 when he became a member of the International Handicappers' Net. Today he keeps busy as one of their board directors and daily net controllers. Every day but Sunday, Dad and the others meet on the air. Some 2,000 names compose their roster.

The International Handicappers' Net

They have a quarterly newsletter filled with great articles about members' accomplishments in the community, at work, and in organizations aiding the handicapped. The readers contribute solutions to operating problems, and sometimes an inspirational bit of poetry. Since most of the members are US Veterans, valuable reports on Social Security Disability Benefits are often included. One of the net chaplain's duties is to announce the deaths of members in the newsletter. These names are listed under "Silent Keys," a touching, symbolic way to say good-bye, a mnemonic for SK which in Morse code means "end of contact".

From the lofty scale of membership in the "President's Committee on Employment of the Handicapped," to the most personal level, helping is what Dad and his friends seem to be about. If a member is low on funds and can't afford to replace a vital piece of equipment, chances are his buddies in the net will pitch in and give him a financial hand. They're a caring group of people, and I'm proud my dad is one of them.

Only One Question

Yes, we've come a long way—my parents, my sister, and I, and of course, ham radio. But after all these years, after all I've learned, I still have one small question left.

It was 1957. Sky King and Penny were in the airplane, nose-diving a thousand miles an hour toward a rocky, treacherous mountain. Uncle Sky had just regained consciousness and reached for the controls when. . .

"With hearty 73s, this is W3TUG signing off!" 73

73 Review *by Terry Churchfield K3HKR*

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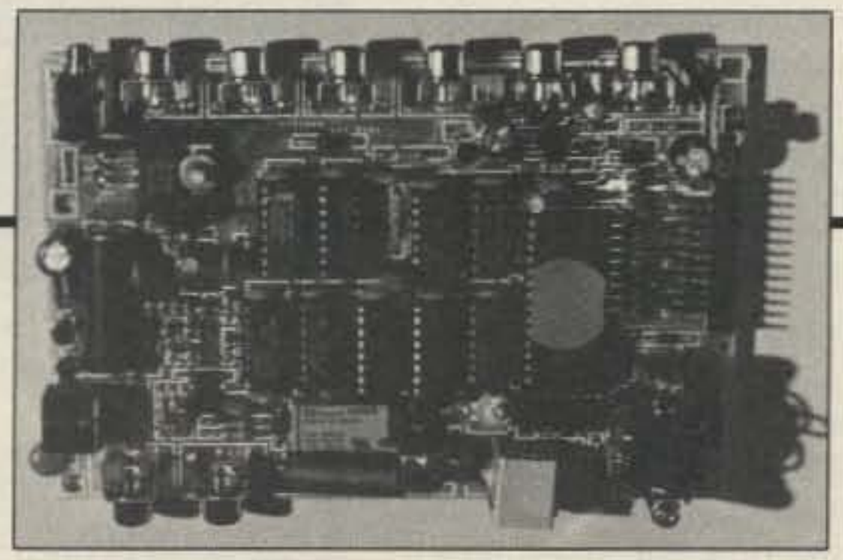

Photo A. The AVT Interface board.

Slow-scan TV (SSTV) has been a specialty in ham radio, practiced by a small group fascinated by the idea of sending video images worldwide on the HF bands. The practice of this mode, however, has been plagued by many problems—the expense of dedicated equipment, the susceptibility of the image to band noise and interference, and the lack of frame resolution, to name a few. The subject of this review, however—the Amiga AVT interface, conceived by Ben Blish N4EJI—uses digital techniques for dealing with slow-scan signals and images with astonishing *results. . . de NS1B*

A. Are you considering trying slow-scan television (SSTV)?
B. Would you like to receive FAX images for weather and news?
C. Do you think that SSTV is not worth the time, energy, or radio spectrum?
D. Are you looking into buying a new computer for business, home, and/or shack?
E. All of the above?
F. None of the above?

Even if you answered "F" to this simple multiple-choice questionnaire, you owe it to yourself to read on!

Life After 20m SSB

Hams with the least amount of curiosity can't help but want to experiment with exotic modes, such as FAX and SSTV. We soon hear, however, how expensive and time-consuming it can be to get involved with them. We couldn't afford, nor talk our wives into, buying equipment dedicated to SSTV or FAX.

Renewed hope came along with the growing availability of personal computer systems. This was something the whole family could use. Most PCs, however, are not designed for high quality graphic output. One recent newcomer is a dramatic exception. . .

The Amiga Computer

In 1985, Commodore Business Machines introduced a new computer using a microprocessor capable of true 16-bit addressing. This computer had the most advanced graphic co-processors of the time and true multitasking capability. Multitasking is the capability of a computer to run two or more programs concurrently. (Programs "time-share" the CPU in tightly-timed cycles.) This was a breakthrough for personal computers.

The Amiga is capable of running MS-DOS programs, so I could upgrade to the Amiga and still use my PC software. With a few inexpensive add-ons, I can run C-64 or Macintosh software. Because of multitasking, I could, for example, operate packet on the PC side and use my word processor on the Amiga side at the same time. The packet information can be saved as an MS-DOS file that I could use in my documents on the Amiga.

The Amiga's true NTSC composite video allowed animation, character generation, and high quality image art output to my VCR. I taped weddings, hamfests, and company picnics, and added graphics and titles to my home VCR movies. This $1600 investment —which comprised an Amiga A2000 micro-

Photo B. The AVT control panel, on lower half of photo.

Photo C. The AVT control panel with I/O window open. The six icons on the screen are coupled to the six input jacks on the AVT interface board.

computer with a floppy drive and 1 megabyte of memory, color monitor, and mouse—really turned out to be useful for the entire family!

A Look at SSTV

Using the Amiga for SSTV had real promise, since I had a nice HF setup. I could get involved with my computer graphics and my radio at the same time, without adding another large expense to the already well-working station. There was still, however, a missing link—an interface that would take video signal data from a receiver and give it to the Amiga in a form it could deal with.

Enter The AVT Interface

The answer came in late 1988, when a group of software and hardware developers, headed by Ben Blish N4EJI, created the Black Belt System "AVT." The hardware is a 3-inch by 5-inch printed circuit board that interfaces between the audio section of the receiver and the parallel port on the Amiga. The software is on a 3.5 inch (880 KB) floppy diskette. The user furnishes a 12 VDC power source, a connection to receiver audio, and an interconnecting cable from the Amiga's digital sound port to the transmitter input. The AVT software requires an Amiga with a megabyte of random access memory (RAM). A color monitor is suggested, but not required.

The Amiga is very user-friendly. I was impressed at how easy it was for me to get the system up and running. The Black Belt System software takes full advantage of the graphic, icon-based user interface. That is, a menu that uses graphics to show choices appears on-screen, and you can move around this menu and make choices with a pointer moved by a small table-top controller called a "mouse."

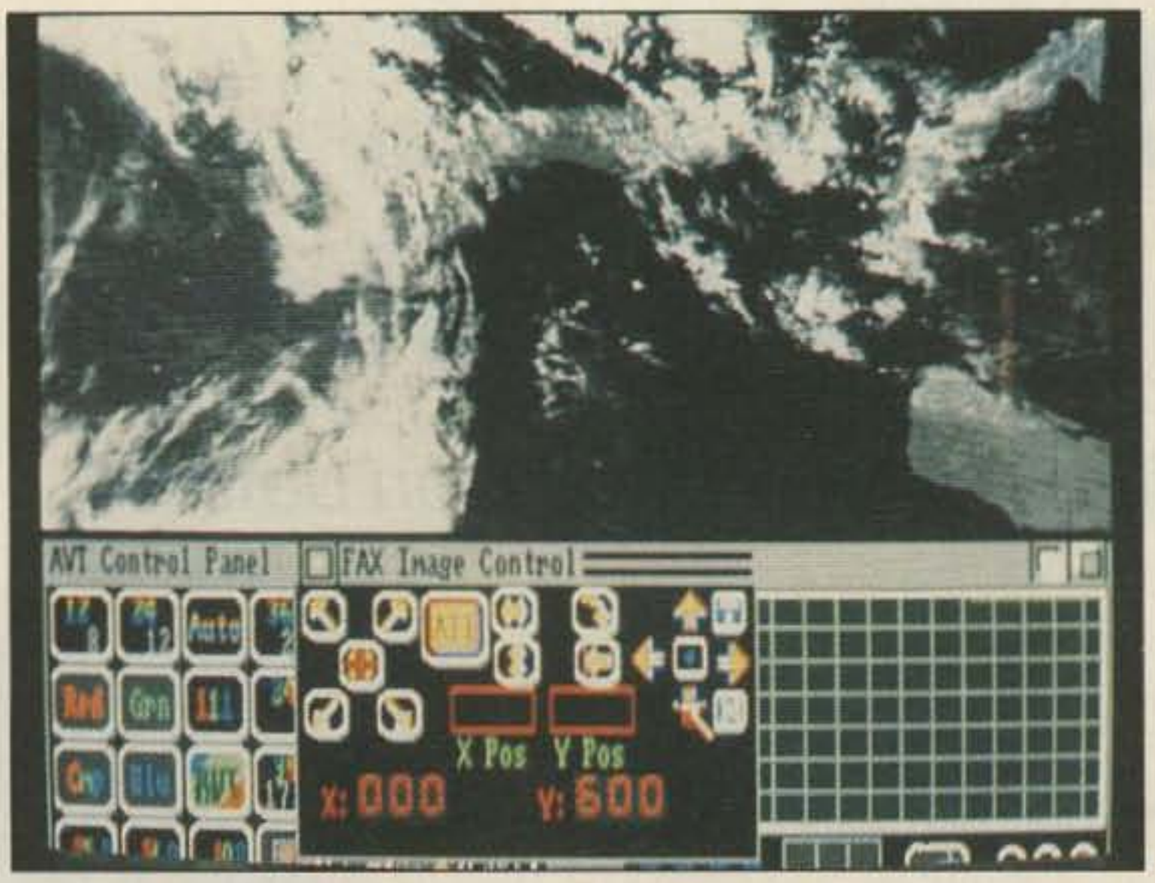

Photo D. Shot of the FAX screen supported by Tim N4IFP's PCB. It supports the images in 16 gray levels. (Most FAX is black and white.)

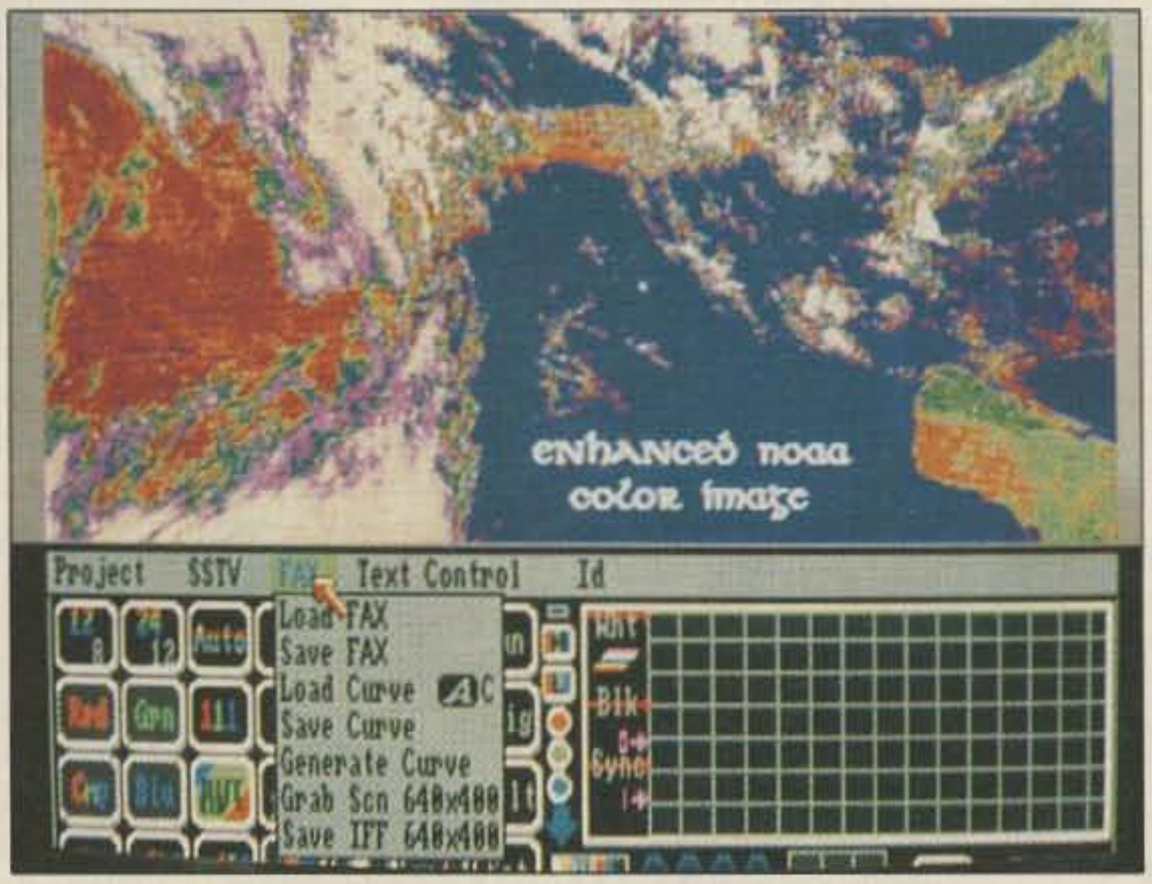

Photo E. Same FAX image as in Photo D, after having gone through PixMate image processing.

AVT vs. Conventional SSTV Modes

The major advantages of the AVT modes over conventional SSTV modes are:

- Images always maintain color accuracy.
- Images always maintain horizontal and vertical position.
- Images always start at the top of the display.
- More efficient use of the radio spectrum.
- The narrow bandwidth allows use of filters and blanker.
- More effective use of the transmitting equipment.
- High and super-high resolutions with black and white/color/3D capability.
- Fully automatic operation.
- Full support to the ARexx interface language.

The first thing I noticed when I got the system up and running was the AVT buttons for 24-second, 90-second, 94-second and 400-pixel modes. The 24-second and 90-second video modes are much like the Robot versions in 24- and 72-second format. In fact, these modes directly support each other almost pixel-for-pixel. AVT modes have a very important difference, however, from the Robot versions—they do not require a transmitted sync pulse.

How is this possible? In conventional modes, these pulses are critical. A missed vertical pulse sends the line back to start, and a missed horizontal pulse causes all sorts of odd things on the received image display.

In an AVT mode, the sync information is sent in a "header"—a block of information sent ahead of the image. The AVT knows what mode and what speed is being sent prior to image information. After the software calculates this information, the system simply sets the "start" position to the top of the screen and begins its scan down the screen. You can even tune to another frequency while receiving an image, and then return to the original, only to have the AVT pick up with the proper scan line at the right position on the image. (A new version of the Black Belt System will contain an image fill-in feature, based on examining the existing image lines!)

The main advantage of the "syncless" system is reduced signal bandwidth. AVT signals are approximately 400 Hz wide—a reduction over the narrowest conventional SSTV signal bandwidth of over three times. You can use your 500 Hz CW filter to isolate it!

Having a narrower bandwidth presents several advantages. With the reduced signal bandwidth comes an increased Signal-to-Noise (S/N) ratio—in this case, about 3–4 dB better than that in conventional SSTV modes. The line noise I heard on some dry weather condition days did not affect the image as much as I'm used to. Another result of narrow bandwidth is the reduction of mutual QRM with neighboring stations. Finally, it more tightly channels the available transmitter energy. I got the same results with the output backed off from the position I had it at when transmitting conventional SSTV.

There are many SSTV modes, with 15–20 of them in popular use. Some of the most popular frequencies include 3.845, 14.230, and 28.680 MHz. There is an Amiga SSTV net operating at 14.233 each Saturday at 02:00 UTC (21:00 EST Friday). Because mode configuration had been hardware dependent, adding new modes to a system could be quite expensive and complicated. Much of the mode configuration in the AVT system, however, is software based, making additions and updates much easier and cheaper.

The current software allows transmit and receive of all the common modes used today. Black Belt Systems updates the software as needed to support new modes as they are developed (such as the Scotty and Martin modes).

Robot Modes

These are the most common SSTV modes. Exchanging images with Robot users via the AVT system is easy. These formats include all monochrome and color. The AVT unit supports both the original US version (60 Hz line frequency, 8.5-second black and white, 128 pixel horizontal by 128 vertical) and the European version (50 Hz, 7.08-second black and white). The Robot 400C, 450C, and 1200C modes are, respectively, 8-second black and white, 12-second black and white, and 24- and 36-second black and white.

The AVT system can both receive and transmit Robot color modes. Included in these modes are 12-second, 24-second, 36-second, and 72-second composite color. All new Robot modes encode the memory (R, G, B or

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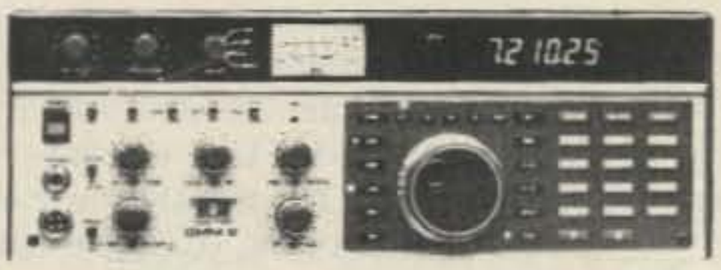

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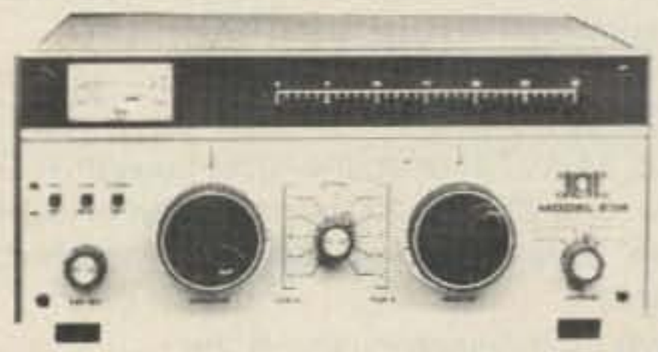

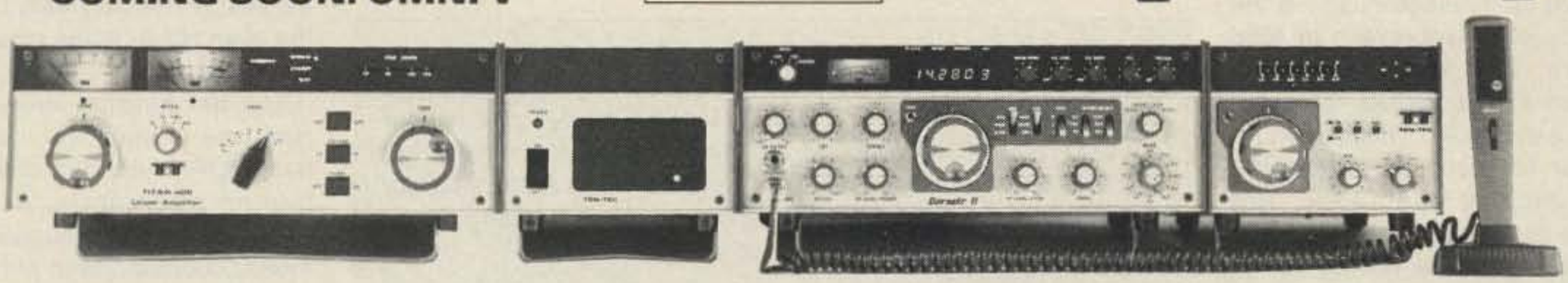

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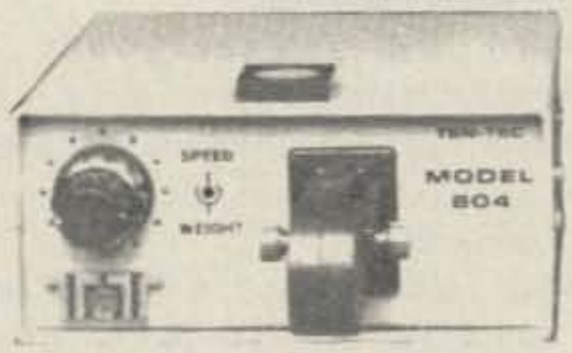

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composite), resolution, and speed of transmission. The AVT system detects this signal and responds accordingly.

Other Popular Modes

Another popular mode is the **WA7WOD Modification** of the Robot 400C, in formats of 17-second black and white, and 25.5-second, 51.0-second, and 102.0-second line-sequential color. The color resolutions up to 256 by 256 pixel are displayed in 4096 colors on the Amiga.

The AVT system supports the **Microcraft Videoscan** modes. These include 17- and 34-second black and white. Resolution is 256 by 256 pixel in monochrome display.

The **Volker-Wrasse** line-sequential system has red sync-locked color modes in 24-second, 48-, and 94- second color formats. Resolution in this format includes 256 by 256 pixel in 4096 colors.

This system even supports the black and white **Visitel** mode (see article in Jan. 1989 73).

When receiving or transmitting any of these modes, the Amiga and AVT system work in 64 gray levels receive/transmit for monochrome, and 64 luma/chroma levels in color. The detail of such images is preserved because the AVT system saves all images in digital format—which maintains image integrity far above that of analog tape storage units.

High-Res Images

The 94 AVT format, the most popular AVT mode, is a 320 by 200 pixel screen in 4096 colors. This mode requires 94 seconds to transmit.

Next up in image quality is the 320 by 400 pixel screen in 4096 colors. This is an interlaced screen and is perfect for direct output to a VCR. This screen requires 184 seconds to transmit. The exciting thing about this mode is the true 3D images that can be produced on the Amiga and transmitted via SSTV. You view the image through a pair of 3D glasses.

The high resolution screen is a whopping 640 by 400 pixels. This screen is sent in only 125 seconds, because it is available only in 16 levels of gray (black and white). At this resolution sending text, PCB layouts, detailed pictures and much more, can be fun and very rewarding. This resolution places the AVT system in a commercial class with some small FAX systems.

All the images sent in AVT modes can be converted into an Amiga file storage format known as IFF (interchange file format). This format allows any picture received to be used with any Amiga graphic program. High resolution images can be converted and later used in desktop publishing programs. Pictures received on the Amiga can be converted into PC images for use on clones or a compatible.

Special Features

I found the higher resolution AVT images of commercial quality, and indeed make SSTV well worth a second and third look. I am building up a library of "slides"—I can fit several such 320 by 200 slides on a single 3.5-inch diskette.

The AVT system is replete with graphics bells and whistles. A simple **Draw** function allows highlighting, touch-up, and features addition. There is a zoom mode that allows picking up a portion of a picture and transmitting that portion.

The drawing function is rivaled by many **Paint** programs that can run as a background task in conjunction with the AVT system. One such program is Photon Paint (MicroIllusions Software, Photon Paint, 17408 Chatsworth Street, Granada Hills, CA 91344, Tel: 800-522-2041). This program directly supports the low and medium modes of the AVT, and does its thing in all 4096 colors.

The **Cleanup** function allows you to use minor image process techniques on poorly received images. Images degraded by multipath, static, etc. are partially recoverable. This process looks at individual neighboring pixels, then decides if the pixel belongs or not. If it does not, then it is simply replaced by the average surround. The AVT system uses a geometric process algorithm by which the image processing is selective from the AVT control panel. This is an added feature not available on other systems.

The **Text Entry** function lets you add text to any picture. The Amiga allows a great number of fonts. The pop-up windows open to reveal a text input screen. Just choose a font style, then preview your text input before you add it to the picture. Here again, the program supports all 4096 colors.

The Amiga supports up to 8 megabytes of memory. At this level you could have several memories waiting for pictures received and prepared to send. I found I could easily review the various memories' contents.

The **Speech** and **CW Tone ID** functions are fun and useful. You can set any text length up to 80 characters. CW transmission is clean and can be made to directly key the transmitter. The voice function has several settings for speed, pitch, and inflection, plus a male voice for the OM and a female voice for the YL. And, the Amiga understands true words—you don't have to type in phonemes.

There is a function that lets you output to a telephone line. That's correct. . .SSTV over the land line! Even if you are not involved with amateur radio, you could use this system to transmit pictures of the family, new baby, or new house over the telephone to friends thousands of miles away in only seconds, in full color. The telephone output is in full duplex.

The I/O routing routines give the operator the ability to route 5 inputs to the output. There are two output connectors, and an RJ-11 phone connector. There is a touch tone pad in this function window.

Since SSTV can be sent over 2m FM repeaters, the touch tone functions could be used to control the repeater for these SSTV modes. For example, you could hold the repeater ID and let the AVT system send it after the picture. It's very easy to route the input signal to the outputs, or vice-versa.

The **Set** function lets you decide how to send the image. In heavy QRM you can choose to turn on notch filters. A narrow transmission mode supports this mode. The bandwidth is cut well below the normal 1.5 kHz (about 400 Hz), so you can use notch filters to cut out QRM and some types of energy QRN. The operator can use 50 or 60 Hz output for NTSC or PAL systems. Some of these functions are available only for the AVT modes.

One underlying feature is the **ARexx Language** option. You can use the ARexx interface with any of the functions. This powerful, high-level script language allows support of macros, scripts, and inter-process communications. The ARexx option is a good way to control the Amiga's multitasking features.

Creating pictures is a lot of fun! I use the "FrameGrabber," by Progressive Peripherals (Progressive Peripherals and Software, FrameGrabber, PixMate Software, 464 Kalamath Street, Denver, CO 80204, Tel: 303–825–

OverView Mini-Review

While I was on the air one night discussing the AVT system, Tim Heffield N4IFP introduced me to a FAX board he just developed. OverView APT allows everything from recording NOAA satellite passes on stereo tape decks, to saving the image (digitally) on the Amiga via the AVT system. The features include:

- Use of low cost recording equipment via a recording technique.
- Phase-locked sync.
- Auto detect of passing satellites.
- Autostart and stop of recording units.
- Tape deck control for use with all Black Belt System modes.
- Control of recording unit and receiver, totally independent of the computer.
- Full multitask support through the AVT system software. (e.g. sending an SSTV image while receiving a NOAA FAX image.)
- A panel-mounted level control for contrast.
- Panel-mounted LEDs for sub-carrier and sync detection.

I was delighted to see how easily this patched to the AVT board. Simply mount the board, connect it using RCA jacks and a sync header pin connector, and add 12 VDC and you are ready to go. A few mouse clicks and you are viewing NOAA satellite passes on the AVT system screen. You can view images in two ways: in real time, or after they have been recorded. There are several commercial applications available for it, including small weather tracking systems for radio and television stations.

Overall, the OverView ATP documentation is very good. It contains numerous hints and details for optimizing image reception. I built, and used, the antenna as described in the manual for a cost of about $20.

4144). This optional interface allows me to input images from my commercial TV, VCR, or Camera. The image is grabbed in real time at 1/30th of a second. The frame grabs are in vivid color and support all resolutions. The AVT has a grab-screen routine that will allow any IFF picture image to be converted to SSTV format for transmission in any mode. You can use the image process software "PixMate," also by Progressive, to further enhance these images prior to broadcast.

FAX

FAX is the latest rage in commercial communications—it allows you to send copies of images over the phone lines. Commercial FAX, however, doesn't support gray scale. Because of this, most FAX systems do not handle halftones very well. Images that print directly to low resolution printers have no value at all. If the 1000 by 1200 pixel FAX image was sent to a printer in 1:1 resolution, the printout would be about 3 inches by 4 inches. That would require a laser printer at 300 DPI output. There is no dot matrix printer on the market that can do true halftones!

in SSTV modes at the 125-second rate. The image is displayed in 16 levels of gray, and may be color-enhanced using any good image process software such as PixMate, mentioned earlier. You can save the FAX images in IFF for conversion into other programs, including direct conversion into PostScript format for laser printers. See the sidebar for a mini review of a particularly effective FAX interface developed for the AVT system.

Getting A Print-Out

You can extract hard copy of the image in several ways. The Amiga presently supports over 200 different printers. The Postscript conversion for up to 2450 DPI resolution is another good way. You could use a thermal video printer. The Amiga supports composite monochrome output for just such a purpose.

Receivers for these satellites are not commonplace. Tim Heffield N4IFP recommends either the Vanguard Labs FMR-260-PL, or the Hamtronics Model R137. These are crystal-controlled units. Insert a good FM preamp at the base of the antenna.

You never know, however, what you may come across at a hamfest. At the '89 Dayton hamfest, a fellow foisted his Lafayette HF 60 rig off on me for $10. This rig receives three different HF and VHF bands, including the 137 MHz NOAA satellite band. With minor tweaking, I started pulling down NOAA signals—without even using an RF preamp!

"The Cleanup function allows you to use minor image process techniques on poorly received images."

I was curious to see how well the FAX modes worked, and a trip to 8.078 MHz was very rewarding. I was pleased to see that the AVT FAX supports up to 16 gray scales. The system worked exceptionally well.

I chose my desired FAX resolution (60 or 120 lines per minute) and the FAX window opened up to reveal some additional functions not available in the SSTV mode. The Amiga allocates a lot of memory for the system (650 KBytes), since FAX images are so information-intensive. The WEFAX images are received in a 1024 by 1200 pixel resolution. The 120 LPM images take 10 minutes to capture, while the 60 LPM image will take 20 minutes.

AVT supports FAX autostart. The AVT looks for a 300 Hz tone being transmitted. If this tone is detected, the AVT proceeds to the phasing state. The AVT then continues to monitor for a ½ scan all-black condition, at the selected line rate. Once detection occurs, the AVT system then locks the time interval to the beginning of a scan line, and reception begins. Fear not! You can override the autostart system even if you missed the sequence completely. In fact, you can enter a FAX receive mode at any time during transmission.

The HF FAX images are sent in black and white. There is full support for 64 levels of gray, in both transmit and receive. The full FAX image can be displayed in a scrolling 600 by 400 window.

The AVT FAX panel contains several gadgets that allow image correction: top to bottom, and side to side. Scroll through and direct the X and Y coordinates. You can size down the 1024 by 1200 image to a 640 by 400 image, then send the smaller resolution picture

Conclusions

The one drawback to the Black Belt AVT System is the computer-generated noise. Because of computer CPU speeds the AVT system becomes a transmitter of noise that can get into a receiver system. With later versions of the hardware and some corrective lead dressing, this problem can be eliminated. I traced a large receiver leak to my RF wattmeter. Simple shielding was the corrective measure.

The AVT documentation leaves a bit to be desired. The user must understand the Amiga to some degree above novice. There is no manual as one might require. You will have to have a printer to get hard copy from the disk.

AEA, however, who will soon be marketing the AVT unit, is producing hard-copy documentation that the beginner can understand.

The Black Belt System is the very latest technology for image reception using audio frequencies. The developers involved with this new technology have broken ground for visual communications via radio, satellite, and telephone. This system lets you transmit over large spans of distance and time, at a cost well within a reasonable budget. The uses of such transmission for business and pleasure are endless.

See you on slow-scan! 73

Number 10 on your Feedback card

73 Review *by Phil Nowak KA9KAF*

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GMS-403 NiCd Charger

Erases charge level "memory" and charges almost any NiCd.

I remember one of Wayne Green's speeches in which he said something like, "One of these days someone will build a charger that cycles NiCds properly. I expect him to make a lot of money with this product." This comment hit home with me one Wednesday in April, two days before the '88 Dayton Hamvention. It was time to locate and charge all the NiCd batteries for the two handie-talkies the YL, Alida KA9KAG, and I were taking along. I don't use my handie-talkies much during the year, so the batteries had been idle for quite some time.

I plugged some batteries into the wall chargers, and changed batteries in the quick charger each time I woke up during the night. On Thursday morning I checked the results. One battery had failed to charge at all. The rest were in some state of charge. They worked the radio, but how long would they last? The YL and I had carried lots of questionable spares before. It wouldn't be the first time she and I had lost communications, and each other, in the giant Hara Arena. It was with this uncertainty that we left for Dayton.

The NiCd Charger

On Friday afternoon, I stood in front of the booth of CPU, Control Products Unlimited. Their model GMS-403 charger appeared to be the answer to my NiCd failure fears. Joe Fell WA3GMS, the company president, described the features of this charger. I was fascinated.

The charger has three switches and three LEDs on the front panel. There is an ON/OFF switch, a three position rotary module select switch, and a three position mode select toggle switch.

The mode switch determines what you do to the battery. You can choose NON-ERASE, ERASE, or ERASE-T-C. The module select switch tells the charger what kind of battery you have connected. Its LEDs are labeled ERASE CHECK, CHARGE, and CHARGE COMPLETE.

Discharging and Charging

The most commonly used position of the mode switch is ERASE. In this mode, the unit discharges the battery or pack connected to it before recharging, erasing any memory. The red ERASE CHECK LED will light up while the battery is discharging. Once the voltage drops to 0.9 volts per cell, the ERASE CHECK turns off and the charge cycle begins.

The charge procedure is different than the ordinary quick charger or wall charger. A charge cycle is 1000 milliseconds, or one second. The unit hits the battery with a four ampere jolt for the first 100 milliseconds. This is to rid the battery of any "whiskering" leading to inter-cell shorting. The CHARGE LED flashes on while charge current is flowing. Nothing happens for the next 600 milliseconds. Then the unit places a 500 mA load on the battery for 16 milliseconds, and measures the battery voltage under load. The ERASE CHECK LED blinks on during this time. Nothing happens for the next 284 milliseconds, and this completes one charge cycle.

The unit continues the charge cycles until the voltage reaches a nominal 1.36 volts per cell. When this happens, the CHARGE COMPLETE LED glows green. If the voltage never gets to 1.36 volts per cell, the unit times out after a predetermined time. In this situation, the CHARGE COMPLETE LED will glow red. In either case, the battery has received all the charge it's going to get.

The NON-ERASE mode works as stated above, except that it skips the discharge step.

Use the ERASE-T-C (time charge) position for older batteries, or to condition new batteries. This mode works like the ERASE mode, except that it lets the battery time out.

This charger is designed to be connected directly across the electrical output terminals of the battery. Wall chargers generally feed AC to the charge jack on the battery back. An internal diode converts this to pulsating DC. The high charge current of the GMS-403 will destroy this diode if you hook it up to the charge jack instead of to the output terminals.

"The unit hits the battery with a four ampere jolt . . . to rid the battery of any 'whiskering' which could lead to inter-cell shorting."

Choosing and Using a Module

How does the unit know what kind of battery you have? You tell the factory and they include a program module for your battery. They need to know the number of cells and the battery Ah rating. Each different battery configuration needs a different module. A module of your choice comes with the charger. Extra modules are $5.00 each. I ordered two

additional modules: one for a nine-cell ICOM BP-5, rated at 450 mAh, and one for an ICOM BP-7 containing seven cells, rated at 800 mAh.

Up to three of these modules plug into the base of the unit. The three-position rotary module select switch on the front of the unit selects the module to be used. It is possible to order an extra side plate with a twelve-position rotary switch and additional module holders, allowing you to use up to fourteen modules. One module slot is used to plug in the module extension board. This extra is available for an additional $89.

The Acid Test

I was pre-sold, but I did hesitate at the price. Even with the usual Dayton discount, it seemed a lot to pay just to charge the batteries. That's what I thought on that Friday.

I couldn't wait to try it out Friday night back at the motel. I fed all of my batteries, both good and bad, to the charger. At this point the first weakness showed up. The original version of the documentation was a poor copy, and poorly written. CPU had spent good money on a nice double-sided promo sheet, but stopped when it came to the instruction sheet. (Note to developers of hardware and software: Either hire a professional with good technical writing skills, or ask people who are unfamiliar with your product if they can figure it out from the instructions.) I couldn't tell if the unit was set up properly. Some of the batteries didn't seem to charge long enough before the green light came on. I got very strange results when I went to charge the BP-5. Oops, my fault, I had selected the BP-3 battery module. I understand CPU is working on a better instruction sheet.

Saturday was the acid test. For some reason the batteries didn't seem to last very long. Fortunately, there were enough spares. Saturday evening all the batteries went back to the charger.

Sunday noon I went back to see Joe Fell at the CPU booth. On the insistence of my YL, I took the charger along also. It turned out that the voltages were set about a volt too low for each of the batteries. There is a procedure in the instructions to remedy this situation, but it wasn't that clear to me because I didn't understand the documentation. Joe was very cooperative in adjusting the unit.

A word about the connectors: They plug into the unit with banana jacks, which is fine. The battery end, however, is a little L-shaped hook. This works okay on older ICOM batteries, but not the newer ones. You have to design and build your own battery connector.

Ultimately Inexpensive

The weekend provided a nice shakedown of the unit. Despite the minor voltage adjustment, inadequate instruction sheet, and awkward connectors, I really liked the unit. It will charge **ANY** NiCd from one to twelve cells—it's definitely not limited to ham radio applications. It is also not limited to any one brand of battery. You can use this unit to charge NiCd batteries for flashlights, video cameras, smoke detectors, toys, laptop computers, portable stereos and tape recorders, to name a few items.

This is where I started to rethink the cost. How often do you buy a new hand-held radio and have to start all over again with another expensive quick charger? When ICOM introduced the BP-8 battery, my old quick charger wouldn't charge it. That's why I never bought a BP-8. Commercial users have the same problem if they change vendors of two-way radio service. When you add up the cost of buying new quick chargers every time you change radios, it doesn't take long to get to the price of the CPU GMS-403, even without a Dayton discount. When you consider that this unit is a universal charger, the cost appears quite reasonable.

Another nice feature is a by-product of the charge cycle. The battery doesn't heat up or overcharge. This advantage, combined with the memory erase feature, should make your batteries last longer than you would expect. Have you priced new NiCds lately?

I no longer worry about my NiCds. They just sit quietly on the shelf until they're needed. If there's any doubt about their condition, a half hour or so in the GMS-403 and they're ready to use, good as new. This is an excellent unit, and one of the few that properly conditions and maintains NiCd batteries. 73

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Uniden Corporation of America has purchased the consumer products line of Regency Electronics Inc. for $12,000,000. To celebrate this purchase, we're having our largest scanner sale in history! Use the coupon in this ad for big savings. Hurry...offer ends September 30, 1989.

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Bearcat® 760XLT-T

List price $499.95/**CE price $244.95/SPECIAL**
12-Band, 100 Channel • Crystalless • AC/DC
Frequency range: 29-54, 118-174, 406-512, 806-956 MHz. Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.
The *Bearcat* 760XLT has 100 programmable channels organized as five channel banks for easy use, and 12 bands of coverage including the 800 MHz. band. The *Bearcat* 760XLT mounts neatly under the dash and connects directly to fuse block or battery. The unit also has an AC adaptor, flip down stand and telescopic antenna for desk top use. 6-5/16" W x 1⅝" H x 7⅜" D. Model **BC 590XLT-T** is a similar version without the 800 MHz. band for only $194.95. Order your scanner from CEI today.

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R4010-T *Regency* 10 channel handheld scanner...$114.95
R1600-T *Regency* 100 channel mobile scanner ...$244.95
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P210-T *Regency* 40 channel CB Mobile $56.95
P220-T *Regency* 40 channel CB Mobile $79.95
P300-T *Regency* 40 channel SSB CB Mobile.....$137.95
P400-T *Regency* 40 channel SSB CB Base.....$174.95
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PR120-T *Regency* "micro" size radar detector....$144.95
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List price $799.95/**CE price $299.95/SPECIAL**
16 Channel • 25 Watt Transceiver • Priority
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★★★ Uniden CB Radios ★★★

The *Uniden* line of Citizens Band Radio transceivers is styled to compliment other mobile audio equipment. Uniden CB radios are so reliable that they have a two year limited warranty. From the feature packed PRO 810E to the 310E handheld, there is no better Citizens Band radio on the market today.

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KARATE-T *Uniden* 40 channel rescue radio $53.95
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Bearcat® 200XLT-T

List price $509.95/**CE price $254.95/SPECIAL**
12-Band, 200 Channel • 800 MHz. Handheld Search • Limit • Hold • Priority • Lockout
Frequency range: 29-54, 118-174, 406-512, 806-956 MHz. Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.
The *Bearcat* 200XLT sets a new standard for handheld scanners in performance and dependability. This full featured unit has 200 programmable channels with 10 scanning banks and 12 band coverage. If you want a very similar model without the 800 MHz. band and 100 channels, order the **BC 100XLT-T** for only $189.95. Includes antenna, carrying case with belt loop, ni-cad battery pack, AC adapter and earphone. Order your scanner now.

Bearcat® 800XLT-T

List price $549.95/**CE price $259.95/SPECIAL**
12-Band, 40 Channel • No-crystal scanner Priority control • Search/Scan • AC/DC
Bands: 29-54, 118-174, 406-512, 806-912 MHz.
The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¼" x 4½" x 12½." If you do not need the 800 MHz. band, a similar model called the **BC 210XLT-T** is available for $178.95.

Bearcat® 145XL-T

List price $189.95/**CE price $94.95/SPECIAL**
10-Band, 16 Channel • No-crystal scanner Priority control • Weather search • AC/DC
Bands: 29-54, 136-174, 406-512 MHz.
The *Bearcat* 145XL is a 16 channel, programmable scanner covering ten frequency bands. The unit features a built-in delay function that adds a three second delay on all channels to prevent missed transmissions. A mobile version called the **BC560XLT-T** featuring priority, weather search, channel lockout and more is available for $94.95. CEI's package price includes mobile mounting bracket and mobile power cord.

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List price $499.95/**CE price $239.95/SPECIAL**
10 Meter Mobile Transceiver • Digital VFO Full Band Coverage • All-Mode Operation Backlit liquid crystal display • Auto Squelch RIT • Preprogrammed 10 KHz. Channels
Frequency Coverage: 28.0000 MHz. to 29.6999 MHz.
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NEW! President® HR2600-T

List price $599.95/**CE price $299.95/SPECIAL**
10 Meter Mobile Transceiver • New Features
Delivery for this new product is scheduled for June, 1989.
The new *President* HR2600 Mobile 10 Meter Transceiver is similar to the *Uniden* HR2510 but now has repeater offsets (100 KHz.) and CTCSS encode.

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R2060-T *Regency* 60 channel scanner.....$149.95
TS2-T *Regency* 75 channel scanner.....$269.95
UC102-T *Regency* VHF 2 ch. 1 Watt transceiver...$114.95
BPS5-T *Regency* 16 amp reg. power supply.....$179.95
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CIRCLE 121 ON READER SERVICE CARD

Four In/Five Out

Independently adjustable mixed audio outputs.

by John R. Flint KAØLDB

You're driving down the highway, an hour from home. It's late, and no one is on the local repeater. A front is moving in from the west, and it looks bad. You pick up the mike, hit a few buttons, and instantly you're linked to another repeater a hundred miles to the west. Someone can fill you in on what to expect in a few hours.

Remote bases are not new, but an easy way to adjust, mix, and distribute audio hasn't been covered in the literature. In the above system, audio from both the UHF repeater receiver and the 220 remote base receiver are fed through a switching circuit and into the mixer. The outputs of the mixer are connected to the UHF repeater transmitter, the 220 remote base transmitter, and to the control decoder. See Figure 1.

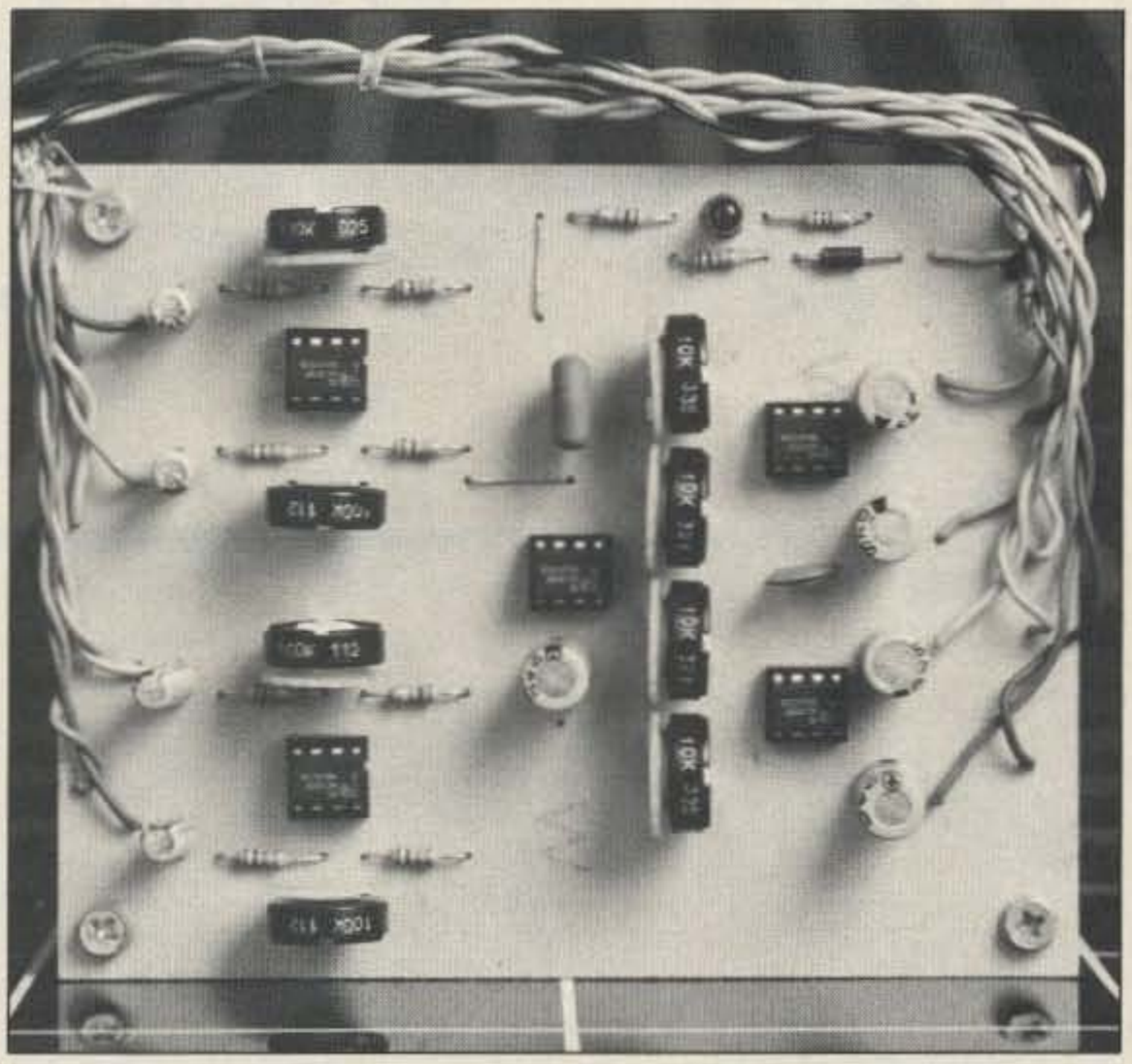

Photo A. Four In/Five Out audio mixer board.

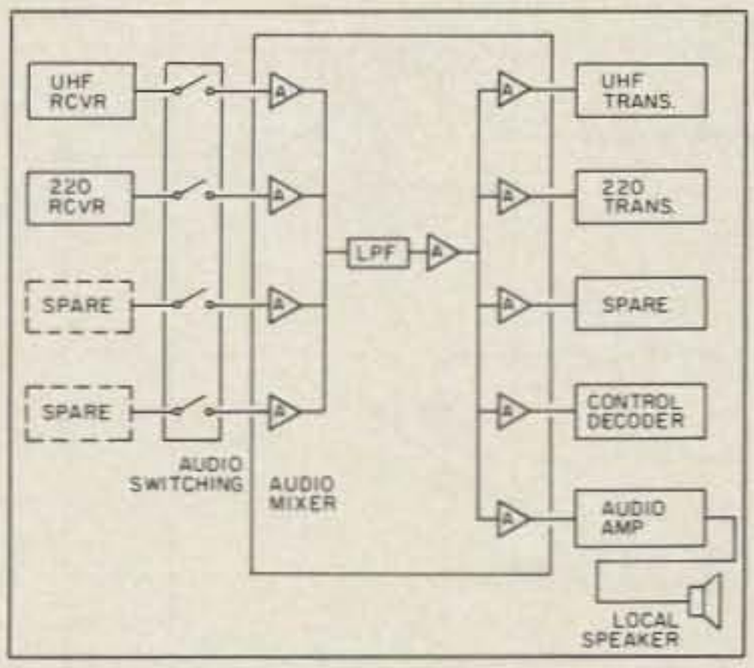

Figure 1. Block diagram of the Four In/Five Out audio mixer.

The Problem

I first worked a repeater at the University of Missouri with the Rolla Amateur Radio Club (WØEEE). Funds were limited, but we had a repeater on the air in four months. We'd worked out most of the bugs, except for two that were particularly aggravating: muffled transmitter audio (the main problem) and an inability to mix additional audio signals not originally planned for. Several local hams were building repeaters and had similar problems.

The Answer

Mahlon Haunschild N4PSD and I researched the available articles for a solution. The common circuit at the time was a potentiometer network feeding into a single transistor amplifier. The drawback of this configuration was that the input impedance, and therefore the audio level, changes on *all* inputs, when any input is adjusted. We sought a better solution.

The solution turned out to be a simple two input/one output op amp mixer which Mahlon had built during a school holiday. It performed as expected, and it's still operating more than five years later.

I built two more audio mixers, a four input/two output, and an eight input/four output. To build each of these took about six hours. I had invested enough time into handwiring these mixers, and I decided to make a printed circuit board (see Figure 2—foil diagram).

Circuit Workings

The final configuration of the mixer was four inputs and five outputs. An op amp for each stage may seem extravagant, but it allows both individual gain select and input isolation. Several of these mixers are in service and working well.

Five basic parts comprise the mixer (see Figure 3). The power portion of the mixer consists of a series-connected diode (D2) which protects against reverse polarity. The LED (D1) is an ON indicator, which can be deleted for reduced power consumption. The two resistors, R9 and R10, bias the op amp for operation from a single-ended, 10 to 15 volt power supply. The bias voltage is VDC/2.

A capacitor (C11), located at the output stages, is used for power supply bypassing. Each input stage consists of a DC isolation capacitor and an inverting amplifier. The gain from each stage is set by the ratio of the variable resistor to the input resistor (for example, gain=VR2/R2=100k/10k=10). To adjust the maximum gain of each stage, substitute a different value trimpot for the one shown.

The output from each input stage is mixed through a 10k resistor. This arrangement results in a voltage divider which is equivalent to a 10k resistor series connected to a 3.33k resistor (three 10k resistors in parallel). Inputs are attenuated to a quarter of the gain calculated above.

The 0.01 microfarad capacitor (C5) with the three 10k resistors in parallel, form a low-pass filter to cut off frequencies above 6 kHz (see Figure 4). The mixed audio is routed to an op amp (U3A) wired as a unity gain buffer. The low-pass filter sees a very high impedance load so the cut-off frequency isn't affected.

The buffer also provides the level required to drive the output stages. One of the output stages (U3B) is not adjustable. You can use it to drive a local audio amplifier or any load with an internal gain control. The four other outputs are similar, except that they have level adjustments.

A note on the layout of the PC board:

Figure 2. PCB foil diagram of audio mixer.

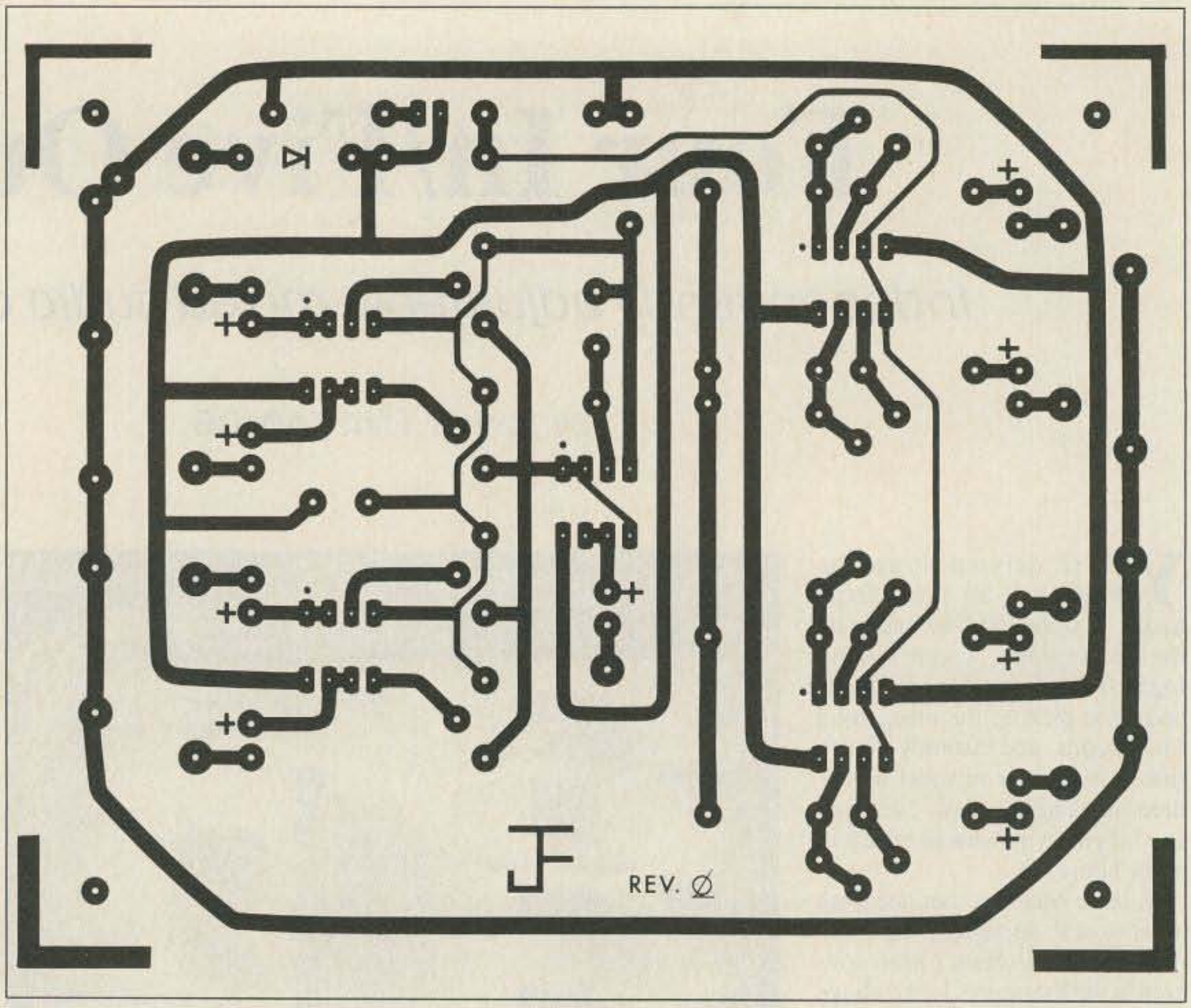

Figure 3. Audio mixer schematic.

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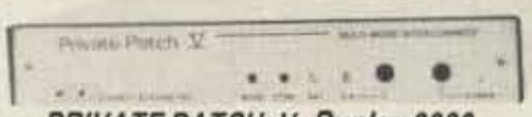

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CIRCLE 41 ON READER SERVICE CARD

Special attention has been given to the ground bus. The signal line grounds are run together to the upper right corner of the board (as viewed from the component side—see Figure 6). The power grounds from the op amps are run together and terminate at the same corner. There are two connections at this point. One is for the power ground which is run with the +VDC wire. The second is for the connection to the enclosure. This should be the only connection to the chassis, thereby eliminating ground loops within the audio circuits.

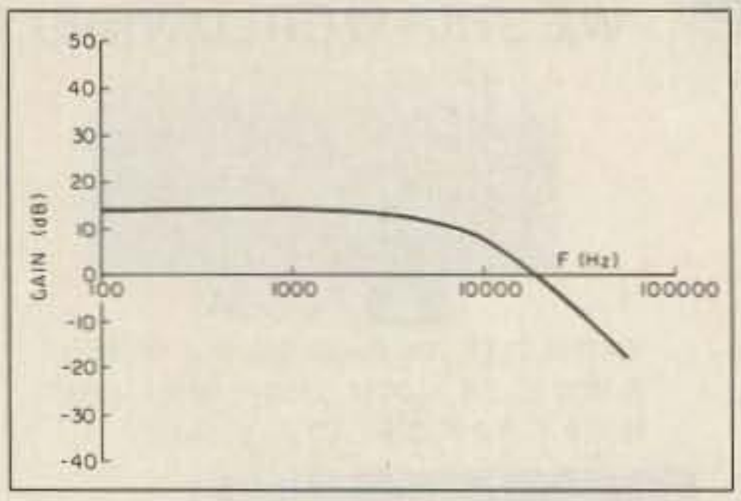

Figure 4. Gain/frequency graph of low-pass filter. The cut-off frequency is defined as 3 dB below the nominal. The nominal gain here is 12 dB, so the cut-off is 9 dB, which occurs around 6 kHz.

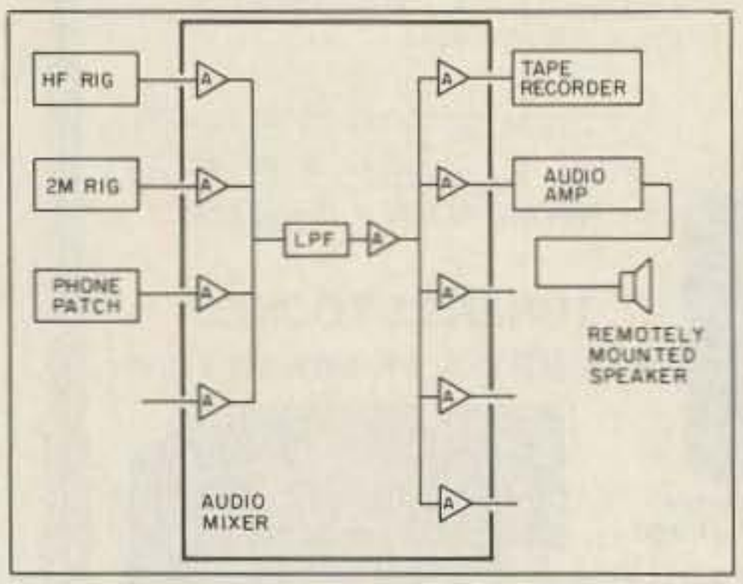

Figure 5. Suggested hook-up for the Four In/Five Out mixer. You can monitor both rigs from the same remote speaker.

What Can You Do with It?

Applications are not limited to repeaters. In the shack, multiple sources are often combined. You can replace the board-mounted trimpots with panel mount pots, for easy adjustment. If the wire lengths exceed a couple of inches, be sure to use shielded wire. If you are driving the mixer from a speaker output, provide a suitable load for the source. Let me know if you come up with any unusual applications.

One example is to connect the outputs of an HF rig, 2 meter rig, and a phone patch, to the inputs of the mixer. You can then use an output to connect a tape recorder. You can adjust the inputs for proper levels, and record any of the input sources without constantly changing patch cords and adjusting levels. You can use another output with a small audio amp for a remote speaker. This allows you to monitor both rigs on one speaker (see Figure 5).

Construction of the Mixer

The mixer, built from readily available parts, is designed for ease of servicing. You can obtain parts mail order or from Radio Shack. Construction isn't critical; perf board is fine.

I like to keep the inputs on one side of the board, and the outputs on the other (see Figure 6). This makes troubleshooting much easier. If space is at a premium, you can make the mixer smaller by using miniature components. The printed circuit board for this project, with schematic and component layout, is available for $15, including shipping. I hope this project will solve some of your audio problems. 73

Parts and Price List

Part	Description	Jameco (except as noted)
R1–R10	10k 5% 0.25W	$ 0.06 ea.
R11	1.2k 5% 0.25W	0.06 ea.
VR1–VR8	100k vertical trimpot	0.59. (Radio Shack)
C1–C4	4.7 µF 25V DC	0.12 ea.
C5, C11	0.01 µF 50V DC	0.06 ea.
C6–C10	47 µF 25V DC	0.15 ea.
U1–U5	MC1458 dual op amp	0.39 ea.
D1	0.200″ LED	0.12 ea.
D2	1N4003 1 Amp diode	0.11 ea.

Total parts price listed above: $8.91

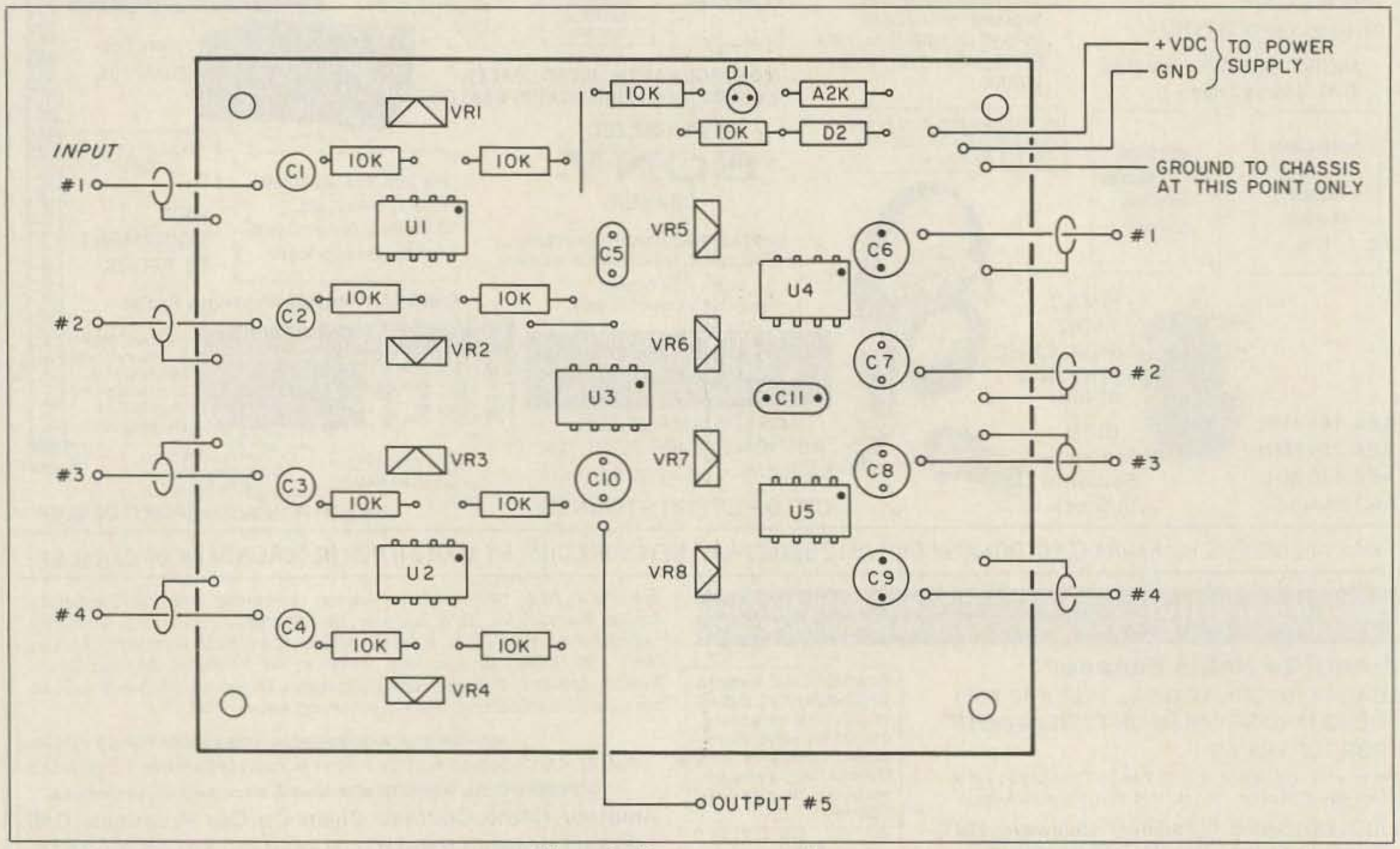

Figure 6. Mixer component layout.

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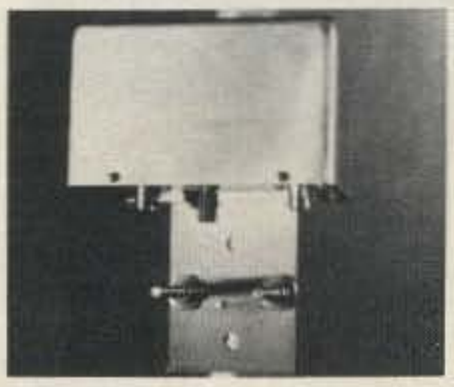
HIGH POWER RF SWITCHED PREAMPS



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10240 NATHAN LANE
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55369
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Model 146 160W 2 Meters 19db Gain .75db Nf
Model 146OS 160W 2 Meters 19db Gain .75db Nf
Model 440 70cm 100W 16db Gain .75db Nf

All preamps have helical filters to prevent out of band intermodulation in the receiver. Model 146 covers the entire 2 meter band. Model 146OS is of very narrow bandwidth and would be suitable for SSB. Packet, or Satellite. Model 440 is factory tunable from 430–440 MHz or 440–450 MHz per customer request. All models are powered with 13 to 20 VDC and are mounted at the antenna.

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Model 440 $189

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Connector options: BCN $5, UHF $6, N $10
SUPER HOT! GaAs Fet option $20

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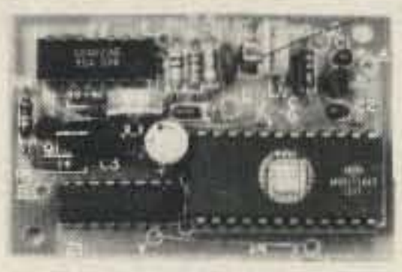
ID-1


ID-2

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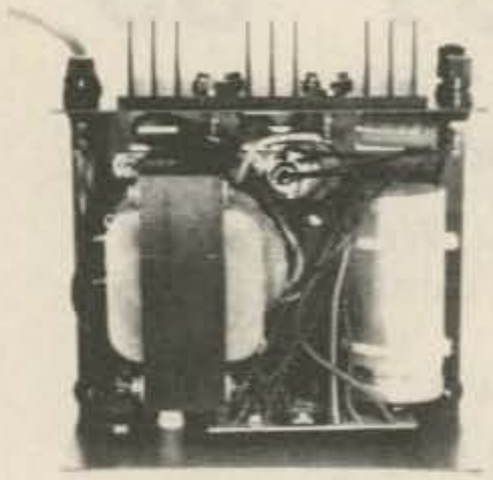
9 Autry
Irvine, CA 92718
(714) 458-7277



INSIDE VIEW — RS-12A

ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
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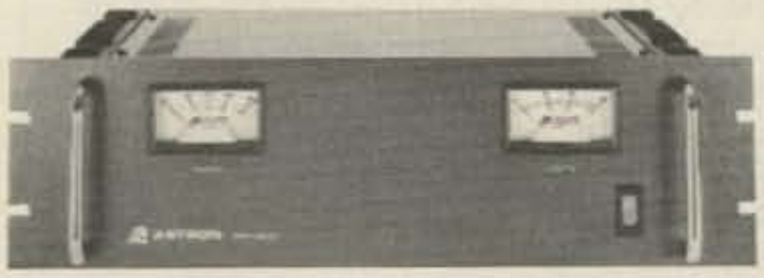
- RIPPLE Less than 5mv peak to peak (full load & low line)
- **Also available with 220 VAC input voltage**

MODEL RS-50A

MODEL RS-50M

MODEL VS-50M

RM SERIES



MODEL RM-35M

19″ × 5¼ RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A	2.5	3	3 × 4¾ × 5¾	4
RS-4A	3	4	3¾ × 6½ × 9	5
RS-5A	4	5	3½ × 6⅛ × 7¼	7
RS-7A	5	7	3¾ × 6½ × 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 × 7½ × 10¾	11
RS-12A	9	12	4½ × 8 × 9	13
RS-12B	9	12	4 × 7½ × 10¾	13
RS-20A	16	20	5 × 9 × 10½	18
RS-35A	25	35	5 × 11 × 11	27
RS-50A	37	50	6 × 13¾ × 11	46

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

VS-M AND VRM-M SERIES

MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	5	7	4 × 7½ × 10¾	10
RS-10S	7.5	10	4 × 7½ × 10¾	12
RS-12S	9	12	4½ × 8 × 9	13
RS-20S	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

Good Mobile Audio— For Pennies

Conveniently feed rig audio to your car speaker system.

by Paul M. Danzer N1II

Once again, I put a new 2 meter rig in my car, and once again, I was disappointed. There is always a lot of high mobile ambient noise in a car. Combine this problem with the small size of the speakers provided with most 2 meter rigs and you end up with with a sound system that just does not provide the clean distinct audio we now routinely expect from modern ham equipment.

Whether this is due to the speaker or to the small size of the audio amplifier is debatable, but the poor results are evident. Years ago, there was plenty of room to neatly add an external speaker to solve the problem. Today's automobiles are much more cramped.

Photo A. The assembled unit to pipe your rig's AF to your car speaker system via the cassette tape pickups.

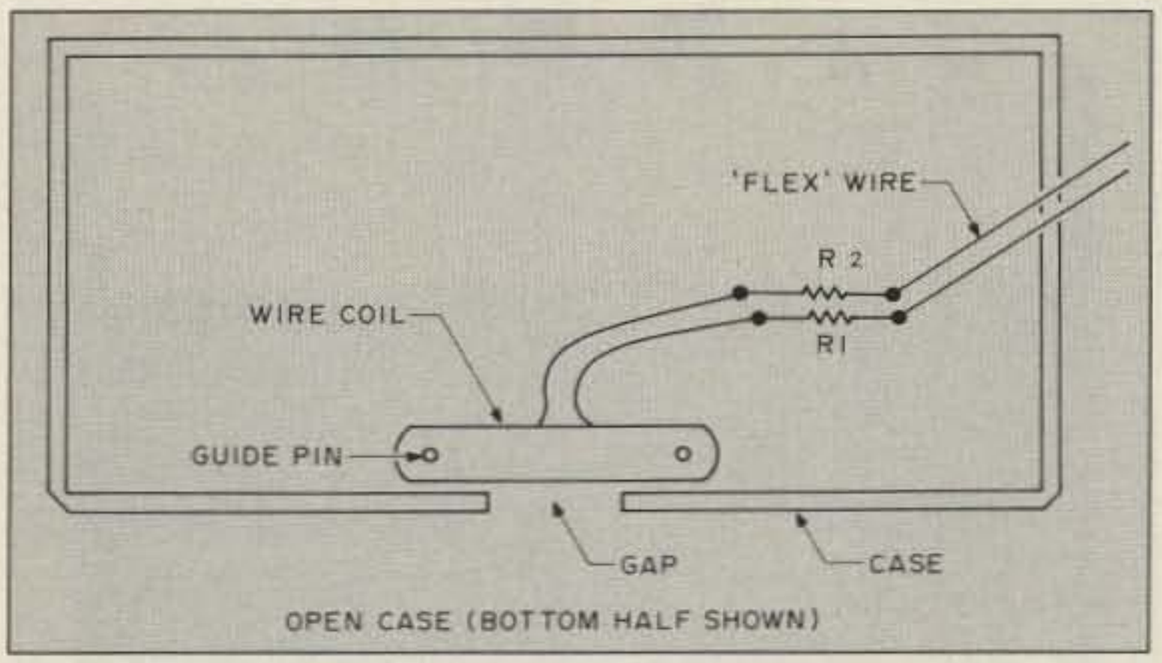


Figure 1. Inside of the cassette tape. Wind 4–5 turns of 28–36 gauge wire around the guide pins.

Solution

Fortunately, today's cars also often have four speakers mounted for the AM/FM radio and cassette player.

The first thought you might have is to open up one of these speaker lines and share it with the two meter rig. On second thought, the problem of switching back and fourth between the ham gear and the entertainment gear gets quite messy.

The answer to this almost universal problem is in the cassette player. Figure 1 shows how to do it.

Start out with a standard audio cassette. If possible, obtain one which can be opened by unscrewing 4 or 5 Phillips-head screws. If necessary, you can use the glued units, but this makes opening them up a little harder.

Next, strip out everything in the cassette. Now, when you look at the bottom half, you will see something like Figure 1, where on each side of the opening for the tape there are two guide pins.

Wind a small coil out of #28, #30, or even #36 enamel wire around the guide pins. The kind of wire to use depends on what you can get, and on what you can handle. (For some people, scraping the enamel off #36 enamel wire is a bit of a task.) For the winding, 5 to 10 turns will be enough. The actual number isn't critical—you'll still end up with plenty of gain for the audio.

The resistors in the figure are there to prevent short-circuiting the audio amplifier. I suspect that the resistors are not really necessary under many circumstances. If the small coil looks like a few ohms (say 4 ohms), no resistors are needed. I prefer to take no chances so I raided my junkbox and used a combination which provided a value of 2 ohms—just to play safe.

Finally, take a length of flexible fine wire, like the kind used for miniature speaker or earphone connections, and lead the wire out of the cassette. Chose the edge of the cassette which will be clear when the cassette is inserted into your cassette player. For some units, you will have to use one short edge, as shown in Figure 1. For other units, the rear (long) edge is the only one clear.

After closing up the cassette, connect a plug to the "flex" wire to match your rig's external audio output jack. Insert the cassette, turn the player and your rig on, and admire the audio. Two front speakers, two rear speakers, front and back fader, left and right adjustment, bass control, treble control, a couple of Watts per channel—what else could you want? 73

73 Review *by Bill Brown WB8ELK*

PC Electronics' TX-33

ATV on the spacious 902–928 MHz band.

PC Electronics
2522 Paxson Lane
Arcadia CA 91006-8537
(818) 447–4565
Price Class: $300

Come on up to 900 MHz! The higher bands available to ATV operation are relatively clear of interference from other modes. Also, operation on the higher frequencies lets you operate full duplex ATV with stations active on 70cm! When used as a crossband repeater input or output, it's now possible to see the repeater while transmitting through it. A 900 MHz system makes weather radar inputs and linkups to other ATV repeaters simple.

PC Electronics has made it easy to enjoy this band with the introduction of a complete 900 MHz ATV transmitter, Model TX-33, with a built-in sound subcarrier. The Model TX-33 is housed in the same style cabinet as their other systems. It should stack nicely in your hamshack. They also offer a repeater version in a Hammond die-cast box, the RTX-33.

Photo A. Front view of the TX-33.

Using the TX-33

The TX-33 has a 1 Watt PEP output with an adjustable blanking pedestal. You can adjust your transmitter for proper operation with various amplifiers, such as the Down East 18 Watt model. There is a built-in T/R relay, which routes the antenna through to a companion downconverter. Two front panel controls let you adjust the microphone and line audio inputs independently. A TV camera can be connected by means of a 10-pin connector on the front panel. There is a rear panel RCA jack for connecting a VCR, computer, or cam-corder. A front panel switch selects the video source.

Monitoring your transmissions on your receive TV setup can give false readings due to overload and reflections. The TX-33 has a demodulator circuit onboard which allows you to monitor the actual transmitted signal via a monitor or TV camera viewfinder. This way, you can adjust the video gain control properly instead of relying on feedback from distant stations.

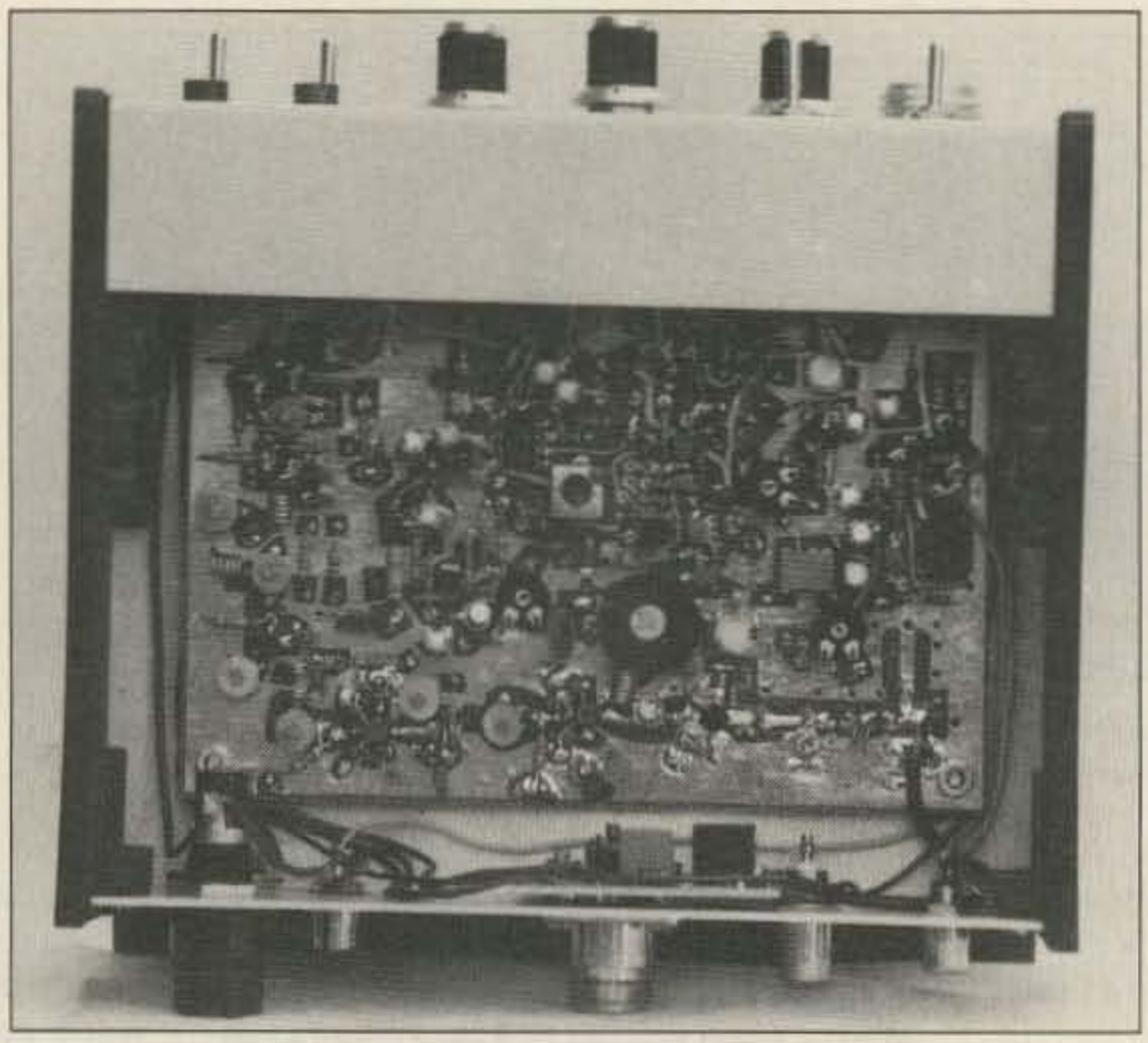


Photo B. Top view of the TX-33's internal PC board.

There is also a push-to-look (PTL) input, similar to a push-to-talk function, that allows you to remotely key the transmitter.

Performance Tests

The TX-33 draws 500 mA at 13.8 volts during transmit. I measured the PEP power output (sync tip) at 1.75 Watts, and the subcarrier sound at −20 dB, referenced to the visual carrier. Upper 2X sound was −55 dB, and lower 2X sound was −43 dB. Subharmonics were well below −50 dB. I didn't detect any spurs or crystal harmonics below the test frequency of 910.25 MHz. The sound subcarrier reached 28 kHz deviation before distortion. Colorbar and multiburst tests indicate an excellent response over the full video bandwidth.

It Would Be Nice If . . .

The TX-33 had vestigial sideband (VSB) signal capabilities, but it transmits only double sideband (DSB). Not to worry, though—there are external filters available for VSB. They are available from *Spectrum International, PO Box 1084, Concord, MA 01742; PH: (508) 263-2145* and *TX/RX Systems, 8625 Industrial Pkwy., Angola, NY 14006; PH: (716) 549-4700.*

Let's See You on 33cm

The TX-33 produces a very clean signal with high quality video and audio. This rig should help make it easier to enjoy the advantages of the increasingly popular 900 MHz band.

Note: Popular ATV frequencies are 910.25, 911.25, and 923.25 MHz. 73

Low-Band Wonder

Inexpensive good gain antenna for 80–20 meters.

by Bill Clarke WA4BLC

IF shifts, notch filters, preamps, filters, and all those other sophisticated signal-enhancers of today's rigs are wonderful, but they all need a signal to shape. So, as it has been from the very beginning, it comes down to having a decent antenna system.

It's often difficult to impossible, however, to find a single antenna to adequately fit all your needs—gain, space efficiency, low-cost, directionality, etc.—especially if you like to operate on the lower HF bands. Directional beams certainly give you the gain, but at what cost? You need the space to erect it and, with the price of aluminum these days, fewer hams can afford even the hardware to "roll their own." And you still need to buy a rotator and control box to aim it where you want.

This problem leads many of us to keep several antennas, each for a specific job. After many years of experimenting, I still haven't found the elusive "be-and-do-everything" antenna. The Low-Band Wonder, however, is one of the better well-rounded antennas I've run across in a long time.

Loop Scoop

This antenna is *basic*. A loop antenna is a closed wire loop that, in free space, radiates perpendicular to its plane. This radiation pattern is bi-directional. Because of this, when you orient the loop horizontally and load it, one of the two lobes radiates upward in all directions.

Loop gain is about 2 dB over a dipole. Furthermore, since it is a closed antenna, it is less susceptible to static noise.

The accepted formula for a closed loop antenna is 1005/freqency (MHz). The results will be in feet. Radiation resistance, theoretically, will be about 100Ω at the design frequency.

Loop Construction

The horizontal loop antenna I use is about as simple as any antenna can be. It is a wire 260 feet in length, held in place at four points to form a 65' square. When you cut the wire at length, connect the center insulator to one end, and choose where you want the feedpoint to be positioned.

The shape can be altered to fit most locations (circle, pentagon, rectangle, etc), as long as it doesn't deviate too much from the basic loop shape.

Mounting height is flexible—try to keep it in the 20–40 foot range. I mounted mine at 25–35 feet, and use trees as the supports.

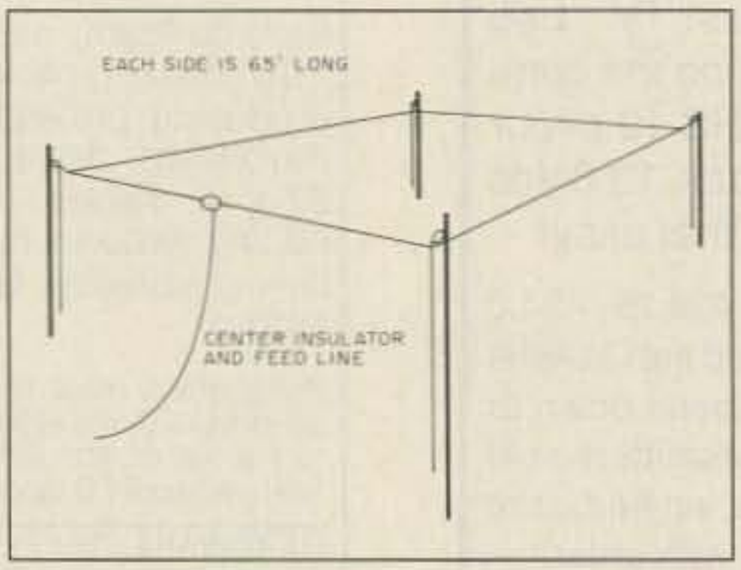


Figure 1. The erected Low-Band Wonder. Raise the loop corners to 20–40 feet.

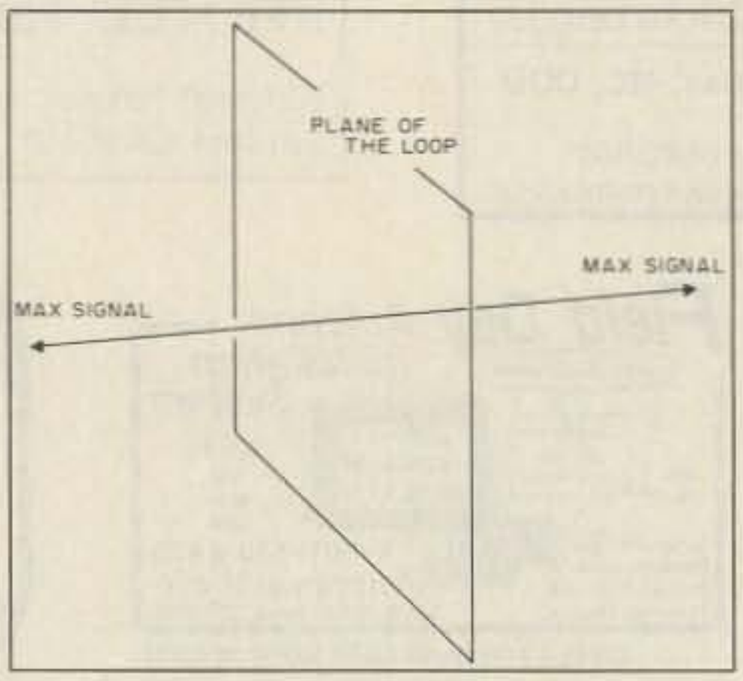


Figure 2. Maximum signal radiates bidirectionally from the loop center, perpendicular to the loop's plane.

Put your support insulators up (on push-up towers, corner of the barn, or trees), and fasten them in place with nylon "hamfest special" rope to allow for adjustment from the ground. You may want to use black rope—it has better resistance to UV light.

Lower each support insulator and feed the free end of your wire through each in order. Then, bring the wire around to the remaining side of the center insulator, and wrap and solder it.

Go to each support line and pull the insulator and loop up until it is near its final resting place. Avoid contact with branches and other antenna wires. BE CAREFUL—avoid power lines! Don't invite injury or possible death.

After you have raised the antenna, go back and make final height and tightness adjustments. Tautness requires only that the loop not be capable of excessive movement. There will be some slack between the support points, which is necessary, as the supports may move independently, causing stress on the loop.

Feedline length is not critical. I tried feeding the loop with twin-lead, open-wire feeders (4" spread), twin-coax, and plain 50Ω coax. I found the last to be the easiest to handle physically, and the most tolerant to tune. You will need a tuner to operate the loop as a tribander.

Now, just select your frequency and tune up as you normally would, adjusting the tuner for lowest SWR. Stand by for resounding signal reports!

Performance

Even though its high radiation patterns and resultant short skip doesn't make it a front-runner for DX, the loop consistently gave me excellent 20 meter signals within the US, and surprisingly good results on 75 and 40 meter DX into Europe.

I would appreciate hearing your comments and experiences with this antenna. 73

Parts List

260 feet of #12 to #18 hard-drawn or copper-weld wire.

200 feet of "hamfest special" nylon rope.

4 (or the number of proposed supports) high quality end insulators (AI-5 4 glass polymer by B&W).

1 center insulator with coax connector.

1 package of Coax-Seal.

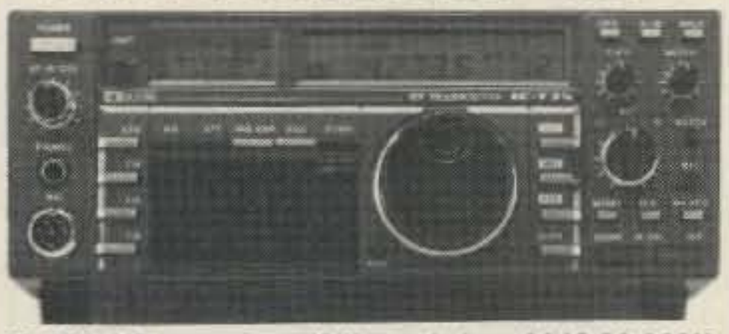
Coax feedline in an appropriate length. Use RG-8X, except for very high power operation.

One stop mail-order shopping for the parts is available from: *Radio Works, Box 6159, Portsmouth, VA 23703, Telephone: (804) 484–0140*.

HF Equipment	Regular	SALE
IC-765 Xcvr/ps/keyer/auto tuner	3149.00	2789
IC-781 Xcvr/Rcvr/ps/tuner/scope ...	6149.00	Call

IC-761 Xcvr/Rcvr/ps/tuner	2699.00	2369
HM-36 Scanning hand microphone	47.00	
SP-20 Ext. speaker w/audio filter ..	149.00	139.95
FL-101 250 Hz 1st IF CW filter	73.50	
FL-53A 250 Hz 2nd IF CW filter	115.00	109.95
FL-102 6 kHz AM filter	59.00	
EX-310 Voice synthesizer.....	59.00	

IC-751A 9-band xcvr/.1-30 MHz rcvr	1699.00	1469
PS-35 Internal power supply	219.00	199.95
FL-63A 250 Hz CW filter (1st IF)....	59.00	
FL-52A 500 Hz CW filter (2nd IF)...	115.00	109.95
FL-53A 250 Hz CW filter (2nd IF)...	115.00	109.95
FL-33 AM filter.....	49.00	
FL-70 2.8 kHz wide SSB filter	59.00	
RC-10 External frequency controller	49.00	



IC-735 HF transceiver/SW rcvr/mic	1149.00	989.95
PS-55 External power supply.....	219.00	199.95
AT-150 Automatic antenna tuner ...	445.00	369.95
FL-32A 500 Hz CW filter	69.00	
EX-243 Electronic keyer unit	64.50	
UT-30 Tone encoder	18.50	
IC-725 Ultra compact HF xcvr/SW rcvr	949.00	849.95

Other Accessories	Regular	SALE
IC-2KL 160-15m solid state amp w/ps	1999.00	1699
EX-627 HF automatic antenna selector	315.00	279.95
PS-15 20A external power supply.....	175.00	159.95
PS-30 Systems p/s w/cord, 6-pin plug	349.00	319.95
MB Mobile mount, 735/751A/761A...	25.99	
SP-3 External speaker	65.00	
SP-7 Small external speaker	51.99	
CR-64 High stab. ref. xtal for 751A....	79.00	
PP-1 Speaker/patch.....	179.00	164.95
SM-6 Desk microphone	47.95	
SM-8 Desk mic - two cables, Scan.....	89.00	
SM-10 Compressor/graph EQ, 8 pin mic	149.00	139.95
AT-100 100W 8-band auto. ant. tuner...	445.00	389.95
AT-500 500W 9-band auto. ant. tuner...	589.00	519.95
AH-2 8-band tuner w/mount & whip....	758.00	689.95
AH-2A Antenna tuner system, only.....	559.00	499.95
GC-5 World clock.....	91.95	79.95

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Precision, Accuracy, and other Topics

Before we get into this month's topics, I'd like to respond to a few comments about my recent review of the Kenwood TH-25AT walkie. Several people wrote to say that it is, in fact, possible to defeat both the battery saver and the auto power-off functions. (Turning off the battery saver is especially important for packet operation.) They referred me to page 21 in the owner's manual, but on checking this, I found no such topic. Kenwood apparently amended the book with this new information.

Precision and Accuracy

My recent column, "The Versatile VOM," prompted a letter from Wendell KD5BF, who pointed out that precision and accuracy are not the same thing.

Indeed, they are not! Precision refers to the degree of specified detail, while accuracy refers to the truthfulness, or correctness, of the specified data. Here's an example: The TV weatherperson says that it will be between 40 and 60 degrees today. The actual reading turns out to be 53. Thus, the forecast was accurate, but not very precise. For tomorrow, the forecast is for 52.47 degrees at 4 PM. It turns out to be 61 degrees. This forecast was very precise, but completely inaccurate.

So what good is one without the other? Not much! The above examples show that precision is useless without accuracy, but that accuracy with little precision doesn't tell you much, either.

In electronics test equipment, manufacturers attempt to balance the two factors. For example, a 3½-digit DMM is accurate enough for the smallest (or "least significant") digit to mean something. A careful review of the specs on some units, though, can reveal that the stated precision, unsupported by the basic accuracy of the instrument, is something of a marketing gimmick. Other factors, such as the input impedance (which, if too low, can load the circuit under test), and the linearity of the analog-to-digital conversion process, can undermine accuracy. I stand by my earlier statement, though: in general, DMMs are both more accurate and more precise than VOMs.

RF Feedback and Hash

If you've got an amplifier, and especially if you use it with a wire antenna, you've probably run into the old "OM, you sure are distorted" RF feedback problem. Prevailing thought seems to be that if your station is properly grounded, and your SWR is low, it won't happen. Nonsense! Of course it shouldn't happen but, all too often, it does.

RF feedback means just that: RF from your transmitter/antenna system is feeding back into your station. The usual path is through the microphone cable, or even into the mike itself. Preamplified mikes are particularly susceptible, because the semiconductors in their low-level preamps make dandy rectifiers for the strong RF fields impinging upon them. Also, the more cables you have hanging off your rig, the more likely you'll have a problem. RF can be conducted through computer cables, speaker cables, even the radio's AC cord! Sometimes wrapping them through toroids helps, sometimes not. Generally, the less stretched out they are, the better. Try coiling them, moving them around, or disconnecting them one by one. Frequently, the path is through one particular cable, and the rest are innocent.

Sometimes the antenna is just too close—that's the situation at the home QTH. There's no problem during clear weather, but when there's ice on the roof, I get terrible feedback (even though the SWR is still 1.2:1). The ice apparently aids RF conduction back into the house. Thoroughly grounding the station hasn't helped. The antenna is only about 20 feet away, and that's just not far enough at the 700–800 Watt level.

Computer Hash

As computers become an integral part of more and more ham shacks, hams are discovering the frustration of coping with the spectral noise these machines generate. Computers are fast square-wave devices, and the harmonics of their varied internal frequencies can seriously degrade reception. Some machines, especially early, poorly shielded ones, are worse than others. I've heard of packet TNCs—computers in their their own right—wiping out the 2 meter signals they are trying to receive. On HF RTTY, the problem is even worse. Although some of the hash can be induced through the antenna, again, most is through cables, just as with RF feedback. Toroids help, and sometimes just moving the equipment around can provide significant improvement. This is one of those problems that's just about impossible to eradicate, but there's much you can do to reduce it.

Man Bites Dog

Yes, television sets can cause interference in your operation (I guess there's some justice in this world!). The color decoding circuitry puts out a nice signal on 3.580 MHz, and the sawtooth sweep currents generate harmonics well up through the HF bands. If you're hearing a buzzing noise every 15 kHz, a nearby TV set's horizontal sweep is the likely culprit.

Short of turning off the set, there's not much you can do. Most sets are in plastic cases, with no shielding around the picture tube yoke (the primary radiator) at all. And the front of the tube is a nice hash generator of its own. That flying electron beam, writing MHz of information at high velocities, can be a real noise-maker in the HF spectrum. Of course, if the offending set is not your own, its signals are a good indicator of when to keep your power down to avoid causing TVI.

Now, let's look at some letters.

Dear Kaboom,

I'm interested in getting my amateur ticket, and I've been trying to listen to SSB ham stations on my National NC-183D. I keep tuning the BFO to try to follow the drifting signals, but I'm not having much luck. Is there a circuit I can build to make SSB reception easier, or is the National just too old for this type of transmission?

Signed,
Drifting Off

Dear Drifting,

I'm not too familiar with that model (I'm a solid state guy), but in general, old AM rigs with BFOs are not well suited to SSB reception. For one thing, they aren't SINGLE sideband; they receive signals on both sidebands at once, making the interference from other stations seem much worse than it really is. Also, as you've found out, the drift is much too high. Short of designing a new VFO, there's not much you can do.

I recommend that you get a simple ham rig, such as a Heath HW-101 or a Kenwood TS-520. It'll work much better and, when you get your ticket, you'll be all set. Hope to hear you on the bands with your new ticket!

Dear Kaboom,

My trusty old KDK FM-2016A 2 meter mobile rig has an odd problem. It transmits off frequency, but only when using +600 offset. Simplex and −600 are fine. What gives?

Signed,
Off-Freq

Dear Off,

This radio uses three crystals, one for each offset, in its synthesis scheme. Crystal X2, located with the other two on the top board, controls the + offset. Try adjusting trimcap VC2. If that puts it back on frequency, then flip the "5UP" switch (on the front panel) to raise the frequency 5 kHz, and adjust trimpot VR1 so that the raised frequency is also correct. If VC2 won't do it, then you'll have to get a new 13.966 MHz crystal for X2. After installing it, be sure to perform the two adjustments to get it exactly on frequency.

Dear Kaboom,

I'm using a Robot 400 SSTV converter with a Panasonic PK-410 color camera. It works, but I get wavy lines through the pictures, especially on bright picture areas. The contrast and brightness controls on the Robot help a little, but not much. Where are those lines coming from?

Signed,
Caught the Wave

Dear Caught,

The Robot 400 is a black and white converter, and its digitization rate is aliasing with the chroma subcarrier coming from the camera, generating beat frequencies that show up as lines on the screen. You could try designing a 3.58 MHz chroma trap in the input stage of the Robot, but a far easier solution is to pick up a cheap black and white camera at your local hamfest.

Have a tech question? Send it off to "Dear Kaboom" at the above address. 73

Upgrade Your CDR Antenna Controller

Add on a high-grade remote antenna selector for under $20.

by John W. Swancara WA6LOD

While attending the local swap meet recently, I picked up a 4-position, electrically driven, coaxial switch assembly with high grade, type N coaxial fittings, all for ten bucks.

Several of my ham friends mentioned that it looked nice, and would be nice to use, but that it required +28 volts. That meant another power supply to buy or build, and run, as well as another control box to clutter up the operating position. But the price was right. Also, I remembered that my CDR HAM-M Rotator uses +28 volts DC to operate the rotator brake.

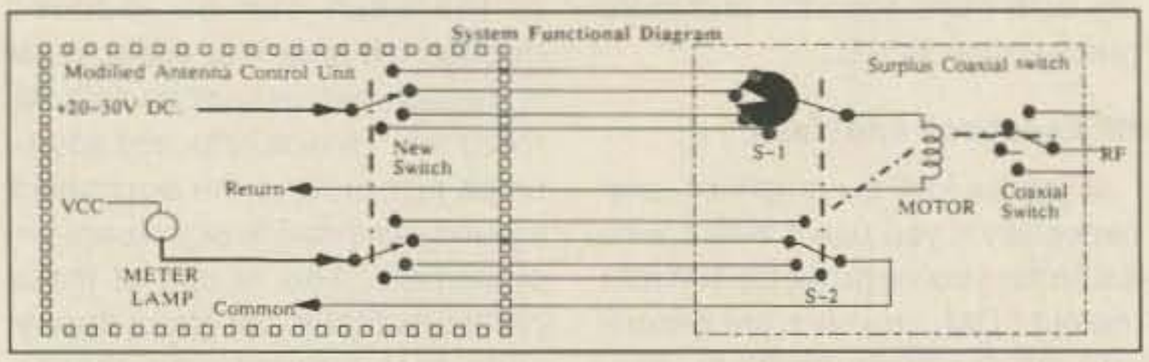

Figure 1. Remote antenna switch system diagram.

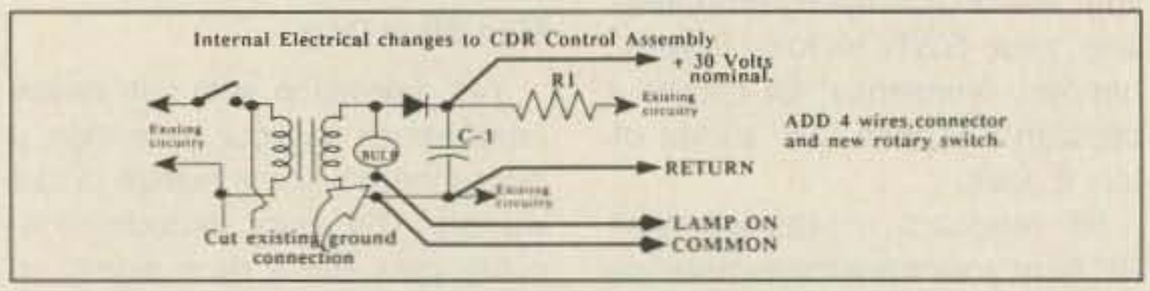

Figure 2. CDR rotator control box rewiring, to accommodate the remote antenna switcher.

I smuggled it past my wife and into my laboratory. Careful disassembly revealed the high quality of the +28 volt, motor driven, high power coaxial sector switch. The unit was manufactured by Weinschel Engineering. A phone call produced a schematic copy of the unit, as well as a reassurance that the item was more than capable of handling ham power levels. The retail price of this item quoted by the engineer would knock your socks off!

While waiting for the schematic to arrive, I tapped off the +28 volt diode and return inside my rotator control box and discovered that the motor drew only 350 mA of power. It also controlled a set of rotary switches (see Figure 1). The first one, S-1, was a 4-position normally shorted with one open, corresponding to the position of the coaxial switch. The second, S-2, was a standard 4-position with normally open contacts.

With the coax switch schematic and a little common sense rework, and CDR control head, I had a very capable remote controlled, 1 kW RF switching system built into my station, with only one coax line going from the HF rig to the outside world. I now access any of the following antenna systems: an 80/40m dipole, a KT-34A beam, a dummy load (under the house with the coaxial switch), and a 17m dipole (What a band!). Here's how to do it:

Modifying the CDR Rotator Control

1. Remove the calibration pot from the front panel and remount it on the back panel. You will seldom need it (Photo B).

2. On the back panel, punch out a hole for a (minimum) 10-pin female connector.

3. Obtain a 2-pole, 4-position rotary switch, and mount it on the front panel, where the calibration pot was located (Photo A).

4. Wire as shown in Figure 2, using your own pin assignments.

5. Add a small overlay on the panel face, with designations as required.

Modifying the Coaxial Switch

Essentially no changes are required. My switch had a very strange miniature 12-pin connector, easily replaced with a standard 10-pin DIN connector that even fit the mounting hole for the old connector (Photo B). The connectors were obtained from Radio Shack at minimum costs.

Operating Your Upgraded CDR

When you make a selection with the new switch, the meter light will go out, while the motor, which is now powered through S-1, resets to the selected position. The meter indicator light will illuminate when the remote selection has been made.

These surplus coaxial switches, as well as magnetic latched DPDT and SPST coaxial switches, are often available at very reasonable prices.

One thing to remember, as an RF engineer reminded me, is that if the switches have type N coaxial connectors, the switch is probably good for 1 kW. You can replace fancy Milspec connectors with DIN or equivalent connectors.

The total cost was a significant savings over the cost of several commercially available switches.

Happy hunting at the swap meets! 73

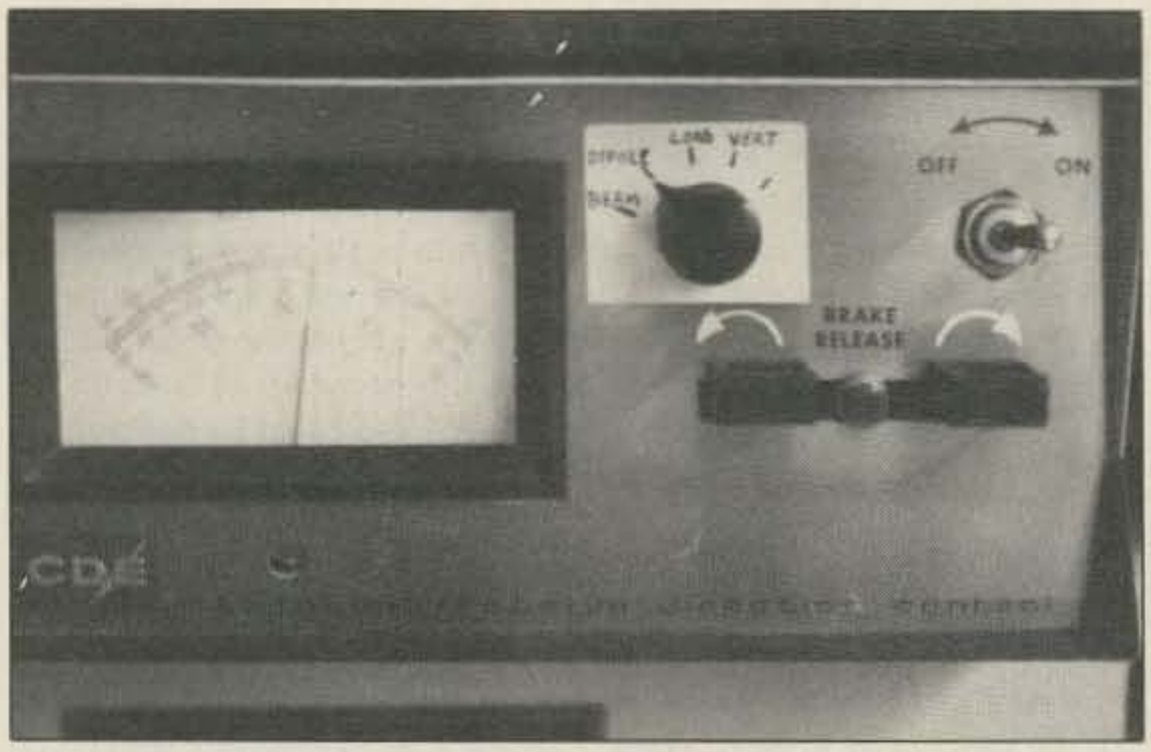

Photo A. Modified front panel of the CDR rotator controller, which now supports the remote antenna selector.

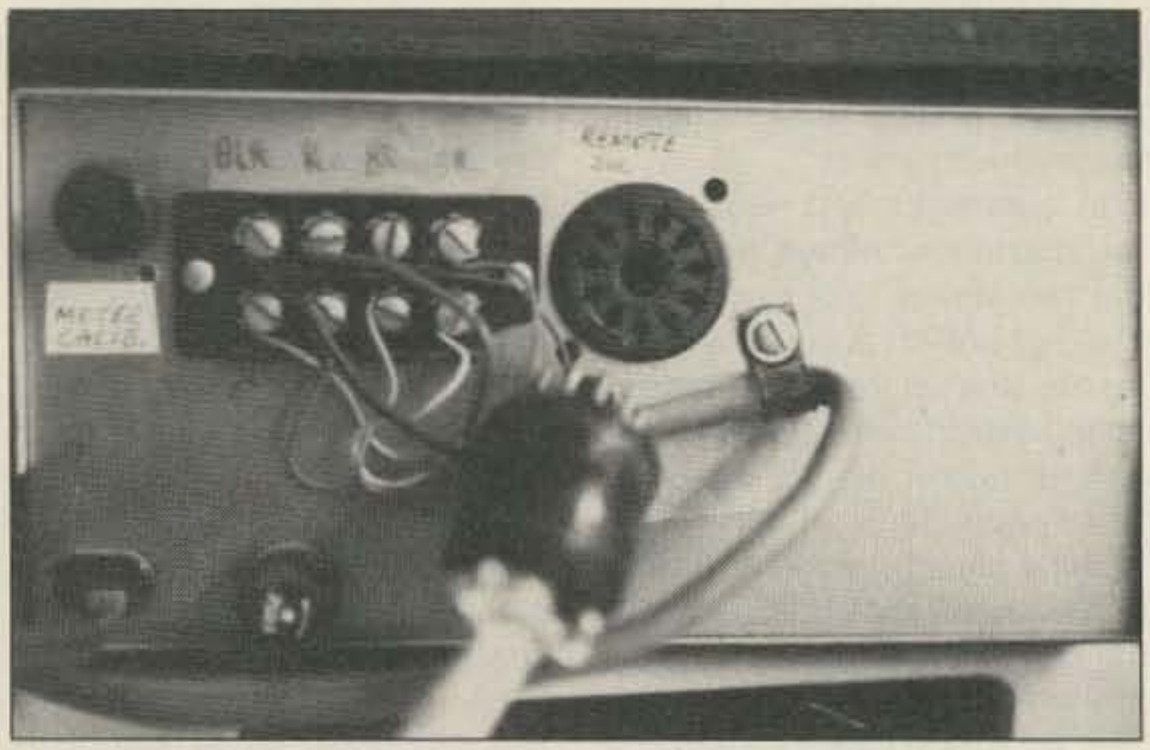

Photo B. CDR rear panel. The relocated calibration pot is at upper left.

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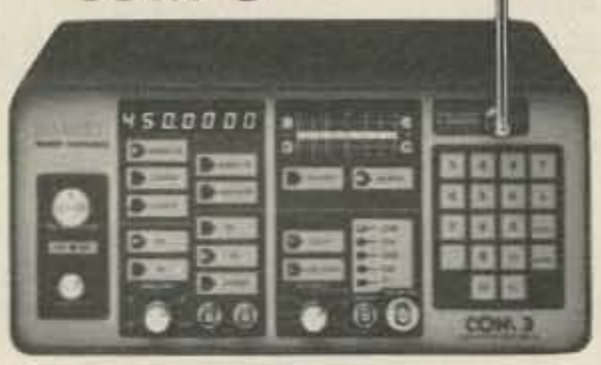

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CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	189.95
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UT-5 Kit **$5.95**

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FM-2 Kit **$4.95**

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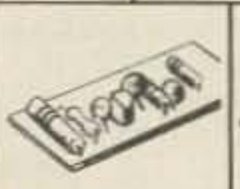

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Case kit, CSS-7 **12.95**

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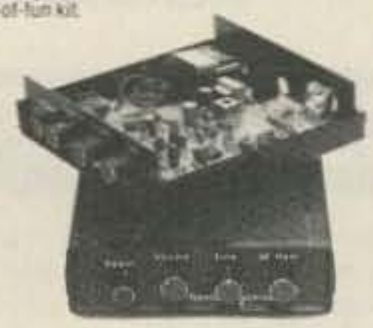
RADIOS



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40 Meter receiver kit, HR-4 **$24.95** 80 Meter receiver kit, HR-8 **$24.95** Receiver case kit, CHR **$12.95**

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Hear exciting aircraft communications—picks up planes up to 100 miles away. Receives 110—136 MHz AM air band, varactor tuned superhet design with AGC, ceramic filter and adjustable squelch. Runs on 9V battery, 50 mw audio output, 1 μv sensitivity. Optional matching ABS plastic case lets you take it anywhere, features screened graphics and machined aluminum knobs for a real professional look. Compact—great for airshows or for just plain hanging around the airport.

Complete kit, AR-1 **$24.95** Receiver case kit, CAR-1 **$12.95**

SHORTWAVE RECEIVER KIT

A fantastic receiver that captures the world with just a 12" antenna! Receives 4—11 MHz in 2 MHz bands, varactor tuned, superhet design with AGC, RF gain control, and 50 mw audio output. Uses new Signetics mixer chip for less than a microvolt sensitivity, runs on 9V battery. This is a fascinating scout, school or club project, and will provide hours of fun even to the most serious DX'er. Add the optional case kit and you have a real nice looking shortwave set.

Complete kit, SR-1 **$24.95** Receiver case kit, CSR-1 **$12.95**

PACKET RADIO

Commodore C64/128 packet radio interface. Uses famous German Digicom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software, PC board, all necessary parts and full documentation.

Complete kit, PC-1 **$49.95**

FM COMMUNICATIONS/2 METER RECEIVER

Sensitive superhet FM receiver tunes any 5 MHz segment from 135—175 MHz. Listen to 2 mtr ham operations, high band police calls, weather or mobile phone calls! Easy to build receiver features varactor tuning, IC mixer stage, ceramic IF filters and dual conversion design with adjustable squelch. Less than 1 μv sensitivity, runs on 9 V battery, with 50 mw audio output. Optional ABS case with screened graphics and machined aluminum knobs provide a nice professional look.

Complete kit, FR-7 **$29.95** Receiver case kit, CFR-7 **$12.95**

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BROADBAND PREAMP

A sensitive all purpose preamp, ideal for scanners, TV sets, VHF, UHF rigs, counters, etc. Features low noise, 4 db NF, 20 db gain, 100 KHz—1 GHz operation. Runs on 9—12 VDC, 50 ohms input.

Complete kit, SA-7 **$12.95**

LIGHT BEAM COMMUNICATORS

Transmits modulated infrared light up to 30 feet without lenses, up to 1/4 mile using lenses. Uses 30 KHz carrier for hum-free operation, transmits thru windows, etc. Ideal for "bugs" or listening to IR remote controls. Transmitter has sensitive mike input, receiver uses PIN detector and drives speaker output. Units operates on 9—12 VDC.

Transmitter kit, LB-6 **$8.95**
Receiver kit, LB-5 **$9.95**

HIGH POWER FM WIRELESS MIKE

A high power unit that will transmit up to 1/2 mile to any FM broadcast radio. Sensitive input accepts any type of mike, will pick up normal voices 10 feet away using the available mini-electric mike cartridge. Operates on 9—12 VDC.

FM-4 kit **$9.95**
Sensitive microphone cartridge **$2.95**

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- LOW COST
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- ONE YEAR WARRANTY

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output allowing you to hit the repeaters full quieting while the low noise preamp remarkably improves receptions. Ramsey Electronics has sold thousands of 2 mtr amp kits but now, we offer completely wired and tested 2 mtr as well 220 MHz units. Both have all the features of the high priced boosters at a fraction of the cost.

PA-10 2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested $59.95
PA-20 220 MHz POWER BOOSTER (8 X power gain)
Fully wired & tested $59.95

plans for ever using 99.83% of your frequencies, yet you're angry when the FCC starts giving them to people who have real needs for them? Please explain this so I'll understand your reasoning.

Please don't tell me about Novice Enhancement and the new League stance on no-code—unless you can point to one single published goal for amateur growth that has been planned. There are no goals because, as far as I know, there are no plans for generating any significant amateur growth. I haven't seen any plans from anyone, have you?

Heck, I see very few amateurs even thinking about it. I get many of the ham club newsletters and they're almost 100% involved with the day-to-day news of their area. This repeater is having a battle with that one. This net is being jammed. That club had a picnic. This one visited the local FAA center. So-and-so worked a couple of new countries.

I don't see any grassroots concern over our unused bands, or any discussion of what to do about it. No, I see the deck chairs on the Titanic being rearranged, with angry battles over which one goes where and who will get to sit in it as the ship sinks.

Publish Or Perish

Few ham clubs are able to maintain their membership and strength without a dedicated club newsletter. It's the glue that helps hold a club together. It helps keep enthusiasm high and bring members to meetings—even if they have to tape Miami Vice to do it. It helps build participation in club events.

Producing newsletters used to be far more difficult and expensive than it is today. Mostly they used to be typed on mimeograph stencils. Drawings were possible but difficult, and photos were impossible. Then, as photo offset presses proliferated, pictures got easier to handle, but we still had to use typewritten copy, so it didn't look very professional.

Now, with Macintosh computers at every turn, cranking out very professional-looking newsletters is a snap. The odds are good you've got at least one club member with a Mac. Talking this person into producing your club newsletter is easy—just show an interest in desktop publishing and wait until the smoke clears.

Many instant printers now have Macintosh desktop publishing setups you can come in and use, paying by the hour.

Getting Material

Many clubs have me on their newsletter mailing list, which I appreciate. I like to know what's going on. Some newsletters are packed with interesting reports from members, others have pathetic admonishments from the editor pleading for material. How do the successful editors get their members to cooperate?

It's not that difficult, but it is necessary to bring some psychology into play. The worst approach is to try and shame people into writing. That not only doesn't work, it ruins the publication for the readers. Leave laying on the guilt to me. What does work is flattery.

If you have a DXer in your club, ask him if he can write a column telling what DX he's worked recently, perhaps including a couple of his prized QSL cards and the stories behind them. Then be sure to tell him how much his column is helping the newsletter, and how many compliments you're hearing about it.

Use the same approach with your leading packet club members, and with RTTY, SSTV, and so on. Find out the special interests of the members and get as many as possible to report monthly on 'em. Motivation is easy: They'll love the opportunity to brag and thus raise their stature in the club, and they'll do all they can to get other members to be involved with their passion. If you have any real pioneers or inventors, don't forget to encourage them to spread their fame worldwide with articles for *73*.

Have you any members who would benefit from getting business from club members? Insurance agents, printers, lawyers? Do a profile of them; run a picture of their shack; have them tell about their business.

For that matter, many of your club members will have some interesting ham related stories to tell . . . if you bother to ask. Who is the most interesting person in the world? Each person has one outstanding favorite: himself. So pump 'em for stories. If some member has been on a DXpedition—even if it was 20 years ago—get him to write it up for you. What was the most interesting QSO? Who is the most interesting ham he's met? Start asking people to write about themselves and your resources are unlimited.

Business meetings can be the death of a club, so use the newsletter as much as possible to get business out of the way. Make sure you have an executive committee and let them handle most of the business, then be sure to report it in the newsletter so members don't get surprises. The remaining business can be whipped through in a few minutes if it's been covered properly in the newsletter. Business kills clubs. It's inherently boring.

When you organize club events use the newsletter to drum up participation. You do this by emphasizing how much fun everyone is going to have. Fun is the key to participation. As soon as clubs aren't fun the attendance will dwindle. When events aren't fun for everyone, they'll blow away. So you have to make sure the benefits of participating in activities are understood by the members.

Get the wives to make the coffee break goodies instead of buying el junko supermarket doughnuts. Try to remember a basic of psychology: The more you get people to do for you, the more they'll like you. The more you do for them, the less they'll like you. So get members to work hard for the club—involve their wives too. Yes, it's actually possible for a ham wife to like a ham club. I realize that my credibility has sunk to a new low with that one, so give it a try and see for yourself. Heh, heh!

Club presidents should make sure the newsletter publisher gets lavish praise and recognition: at meetings, in talking with other members, during contacts over the club repeater, and in the monthly president's message in the newsletter. Lay it on thick.

Once you have a club newsletter going use it as a recruitment medium for new members. Put 'em on the complimentary list for six months or so before giving up. If you have interesting speakers or demonstrations at your meetings you'll get 'em to come out. But without the newsletter, how will they know what fun they're missing?

Newsletter editors can get lots of interesting information to fill empty pages from *Westlink*, put out by Bill Pasternak WA6ITF. This is an excellent source of fast-breaking ham news and well worth the cost. The amount of work this chap puts into his newsletter is incredible. I highly recommend it.

Selling Ads

A newsletter may be of tremendous value in building a club and keeping it strong, but it can be expensive to support. Here's where selling some ads can make a big difference—can actually make a profit. Hey, didn't you ever wonder why there are so many multimillionaire publishers? This will at least cut down on the membership dues needed—and could help buy a bigger and better repeater.

How do you sell ads? Well, you have to do your homework. You don't just start calling and visiting local merchants with an order blank in hand. I suggest you start with a demographic study of your readers. What is their average family income? How many own homes? How many cars do they have per family? How much do they spend on ham gear per year? You want to be able to show potential advertisers that they're missing a good source of business unless they advertise in your newsletter.

Potential advertisers are going to want to know about what readership you've got for them so they can assess the advertising potential of your newsletter. Write this up in a one-page presentation.

What should you charge for ads? Well, how many copies are you distributing? If you have 100 readers you might charge $10 for a page, $6 for a half page and $4 for a third page. You don't have to go smaller than that.

Who are your best advertising prospects? They're all over the place, and local ham dealers are solid gold, of course . . . if you have any. Local ham manufacturers are great, too. But the chances are you're going to have to depend more on local merchants (real estate, photo shops, liquor stores, satellite dishes, car sales, restaurants) and services (plumbing, car repairs, TV repairs).

See that all ad prospects get a brochure on the advantages of advertising in your newsletter. It's a great medium for a discount coupon, by the way.

All this will be lost unless you make sure the members patronize your advertisers. Explain that this is the main difference between America and Russia—here our small businesses are the strength of our country. But small businesses need to have you buying from them, so reward your advertisers with business. With any club cooperation you should be

Continued on page 90

ATV Transmitter from a Microwave Oven!

Low-cost high-power microwave operation has arrived.

by David Pacholok KA9BYI

WARNING

The following construction project is not intended for novice builders! If you are not qualified to work with 5000 volts and 500 Watts of microwave power, ***DO NOT*** *attempt construction of this transmitter. The above power level in the microwave region can be lethal. The author, David Pacholok, and* 73 Magazine *disclaim any responsibility from mishaps resulting from the construction and/or operation of this project.*

The majority of the amateur spectrum allocation lies above 1300 MHz, yet when you scan those bands, you rarely hear anything but band noise. Hams have let these regions lay fallow because of the idea that microwave equipment is complex, expensive, or just unavailable.

To be sure, there are concepts unique to microwave design, but they are not necessarily harder to grasp than those in lower frequency RF design. And, as microwave applications find a larger place in society, as with ovens, and satellite TV, affordability and availability of surplus microwave equipment constantly increases.

Project Features

The goal for this project was to provide an inexpensive, relatively simple high power microwave transmitter using a microwave oven as the foundation. This project meets the following goals:

- Low cost—less than $200.
- High power output—250 Watts minimum.
- Parts readily available from consumer electronic supply houses.
- Emission type compatible with standard low-cost B/W television receivers.
- Frequency of emission in the 2390–2450 MHz amateur band, compatible with Multipoint Distribution System (MDS) TV downconverters. (Historically, these downconverters have been misused to "pirate" television movie distribution at 2156 and 2162 MHz. They have been widely sold through magazine advertisements and electronic flea markets, so there are tens of thousands of them in existence.)

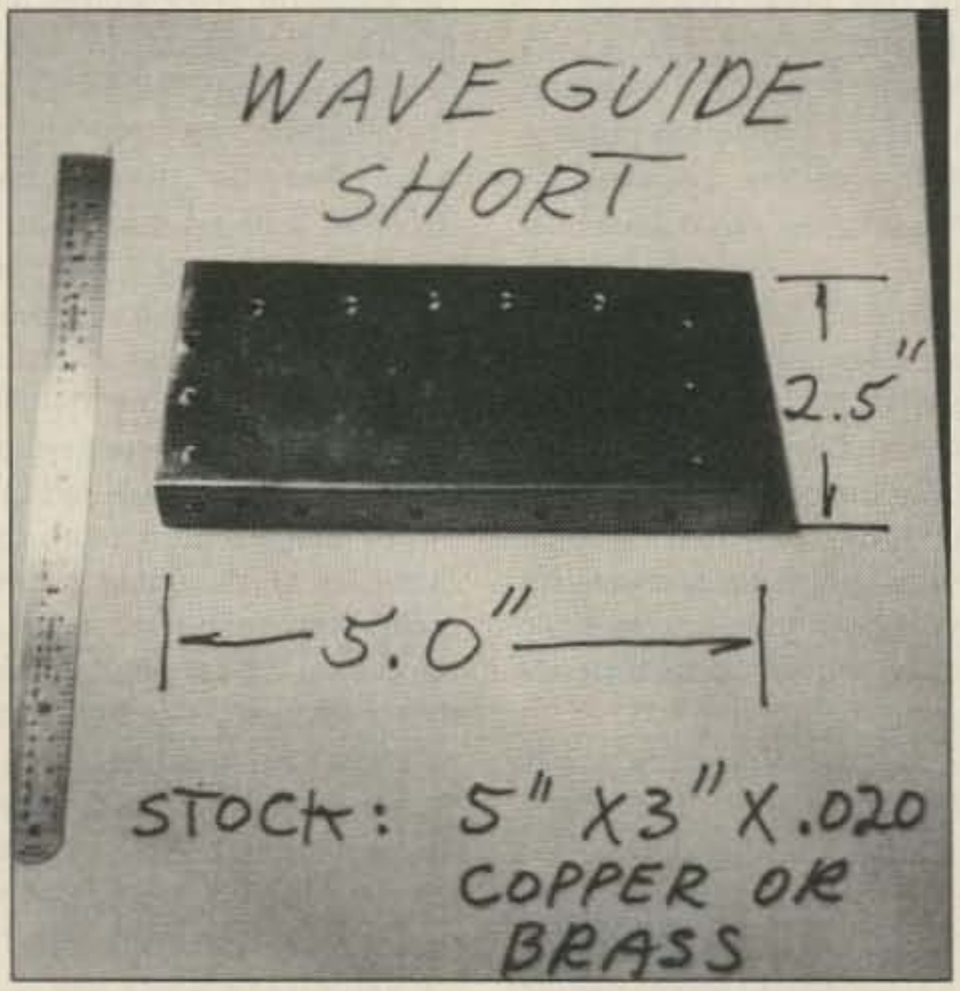

Photo A. Waveguide shorting plate, to prevent the microwave RF from entering the cooking chamber, and to reflect this energy back to an E-field probe.

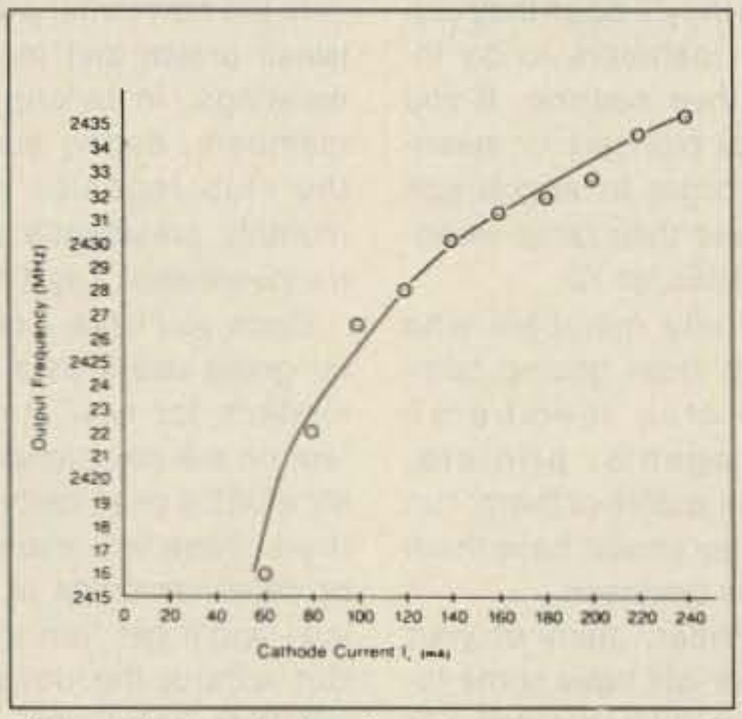

Figure 1. Graph showing frequency versus I_k for the magnetron. This shows that output frequency is (non-linearly) related to current to the magnetron.

- The basic transmitter scheme is adaptable to other emission modes, such as narrowband FM, with phase-lock circuitry described below.

Modification Description

A microwave oven magnetron is a self-contained, crossed-field power oscillator. Built-in cavities primarily determine oscillation frequency, with anode voltage and magnetic field having a secondary effect on this.

First, I modified the magnetron cavity to couple RF to a transmission line instead of to the oven compartment. I removed the interior radome/splatter cover, field stirrer blades, and magnetron output matching section. Next, I shorted the waveguide open end with a plate (Photo A) and installed an E-field probe to couple the RF to an N-connector output jack. (Photo B shows the details of the construction of the E-field probe.)

Magnetron current, voltage, and frequency were measured and plotted independently to quantify performance in this modified cavity. In power output vs. cathode current measurements, for a power out range of 50–400 Watts, and a cathode current of 50–250 mA, I found a very linear relationship. See Figure 1 for the frequency vs. current curve. This data suggests that:

1. The 2M189A magnetron is a current-operated device. The anode-to-cathode voltage changes only about 1 percent, with a 2:1 change in cathode current I_k.
2. Power output is a linear function of I_k.
3. Output frequency is a non-linear (but monotonic) function of I_k, with increased current causing an operating frequency increase. The average frequency "pushing" coefficient is about 0.1 MHz/mA, with a useful frequency swing of about 20 MHz.

What Mode To Use?

The above conclusions ruled out AM double-sideband video, because of the large incidental FM that would result. On the other hand, an FM deviation of 2 MHz would cause incidental AM of only 15–20 percent, so I investigated wideband FM video transmission.

To check compatibility with existing TV receivers, I used an FM video-modulated signal generator as a signal source for an MDS downconverter and a 5-inch monochrome receiver. I got a fair quality picture with the television adjusted for IF slope detection, and with sync and vertical lock achieved at deviations of 700 kHz to 3.0 MHz. The best picture quality occurred at 2.2 MHz deviation.

Modulator Circuit Description

The modulator serves two purposes. First,

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SIL	$ 39.95 Kit

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35 Watt Model 335A	$ 79.95 Kit
75 Watt Model 875A	$119.95 Kit

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it is a high-voltage current source with high open-loop gain, setting the magnetron current to a known value, and establishing a frequency and power output. See Figure 2. U2, a 7805 5-volt regulator, establishes a reference voltage adjusted by R5 and R6. This voltage is applied to the non-inverting input of high-speed op amp U1, which drives source follower Q1. The output of Q1, plus R9 and R7, provide negative feedback to U1 in the ratio 5.7:1. At equilibrium, Q1's drain/source current produces a voltage drop across R11 that equals 5.7 times U1's non-inverting voltage.

Temporarily ignoring screen grid current, plate current equals cathode current in V1 (a,b combined). Since V1's cathode current equals Q1's drain current, V_D rises or falls until the V1 grid 1-to-cathode bias causes $I_P = I_k = I_D = I_S$. V1 is therefore a grounded-grid voltage amplifier with a current gain of unity, with enough voltage capability to drive the magnetron. However, to an input voltage at U1, a transconductance amplifier is formed, with transconductance given by:

$$\frac{\triangle I}{\triangle V} = \left(\frac{R9+R7}{R7}\right)\left(\frac{1}{R11}+\frac{1}{R9+R7}\right) = .22\mho$$

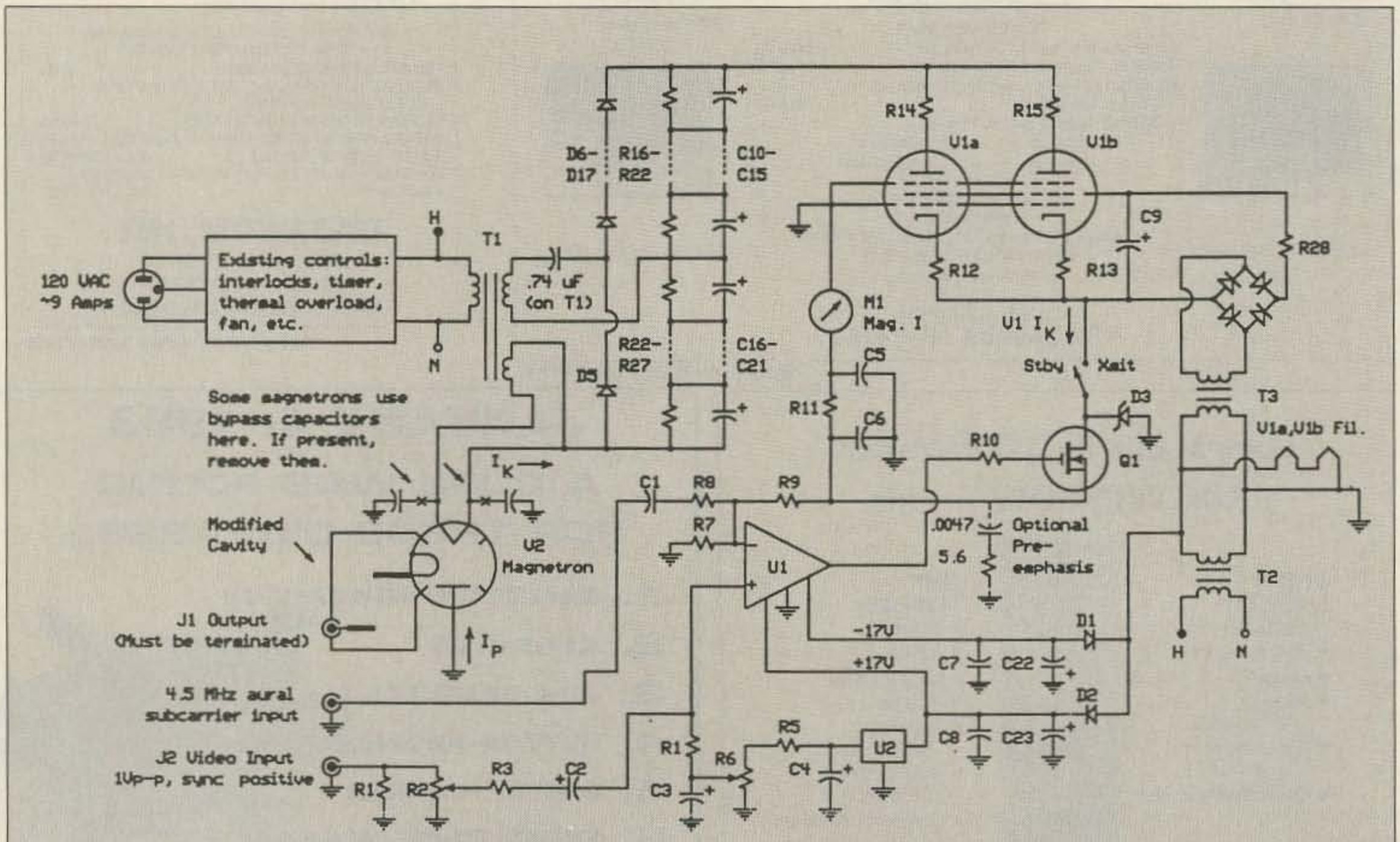
Bandwidth of this amplifier must be sufficient for the modulator's second purpose—video modulation. This must be 4.5 MHz, if you want to include the audio subcarrier. Frequency response measured with a current probe in the plate leads of V1 was down 4 dB at 4.5 MHz. Adding C6 (1200 pF) provides a pole for this frequency, flattening the response to beyond 6 MHz. C1 and R8 serve to couple an external 4.5 MHz subcarrier generator to the modulator.

A floating screen supply of about +100 volts is provided, with R28 included to limit screen dissipation. The floating supply allows only plate current (magnetron current) to be included in the control loop. Additional components with functions are:

- R3, R14, and R15, which prevent parasitic oscillation in U1 and V1.
- R12 and R13, which aid current sharing in V1a and V1b.
- D3, which protects Q1 in the case of V1 arc-over.
- Conventional power supply rectifiers, filters and bleeders.

Waveguide/Cavity Operation

The waveguide circuit is deceptively simple: The oven's TE_{10} waveguide feed (from tube to cavity) is shorted with a copper plate.



Oven	400-500 watt consumer microwave oven. Suitable models include Hotpoint RE6002, Whirlpool MW 1000XS-0 or MW 1200XS-0, Tappan 56-1007-10/02, and Goldstar ER-4020.
V1a,b	6JE6/6LQ6
V2	2M189A or 2M226A magnetron
Q1	VN66AF or similar power FET
U1	LF357 wideband op amp
U2	7805 regulator
D1, D2	1N4001
D3	1N4760, 68V, 1W zener diode
D4	1 amp, 200 PIV bridge rectifier
D5	10 kV, 250 mA diode
D6 - D17	1N4007
C1	.001 uF ceramic
C2	10 uF, 25V
C3, C4	100 uF, 10V
C5	330 uF, 6.3V
C6	1200 pF polystyrene
C7, C8	0.1 uF ceramic
C9	47 uF, 160V
C10 - C21	100 uF, 400WVDC
C22, C23	470 uF, 25V
R1	390 ohm
R2	100 ohm panel-mount potentiometer
R3, R8, R9	470 ohm
R4, R5	3.3 kohm
R6	1 kohm p.c. mount potentiometer
R7	100 ohm
R10	22 ohm
R11	27 ohm, 1 W
R12, R13	120 ohm, 1 W
R14, R15	100 ohm, 1 W
R16 - R27	470 kohm, 1/2 W
T1	Magnetron plate and filament transformer
T2	117 VAC to 12.6 VAC 3.0 A
T3	117 VAC to 12.6 VAC 450 mA
M1	0-200 mA DC
S1	SPST, 0.5 A 125 V
J1	Type "N" female panel mount connector

Figure 2. Transmitter schematic.

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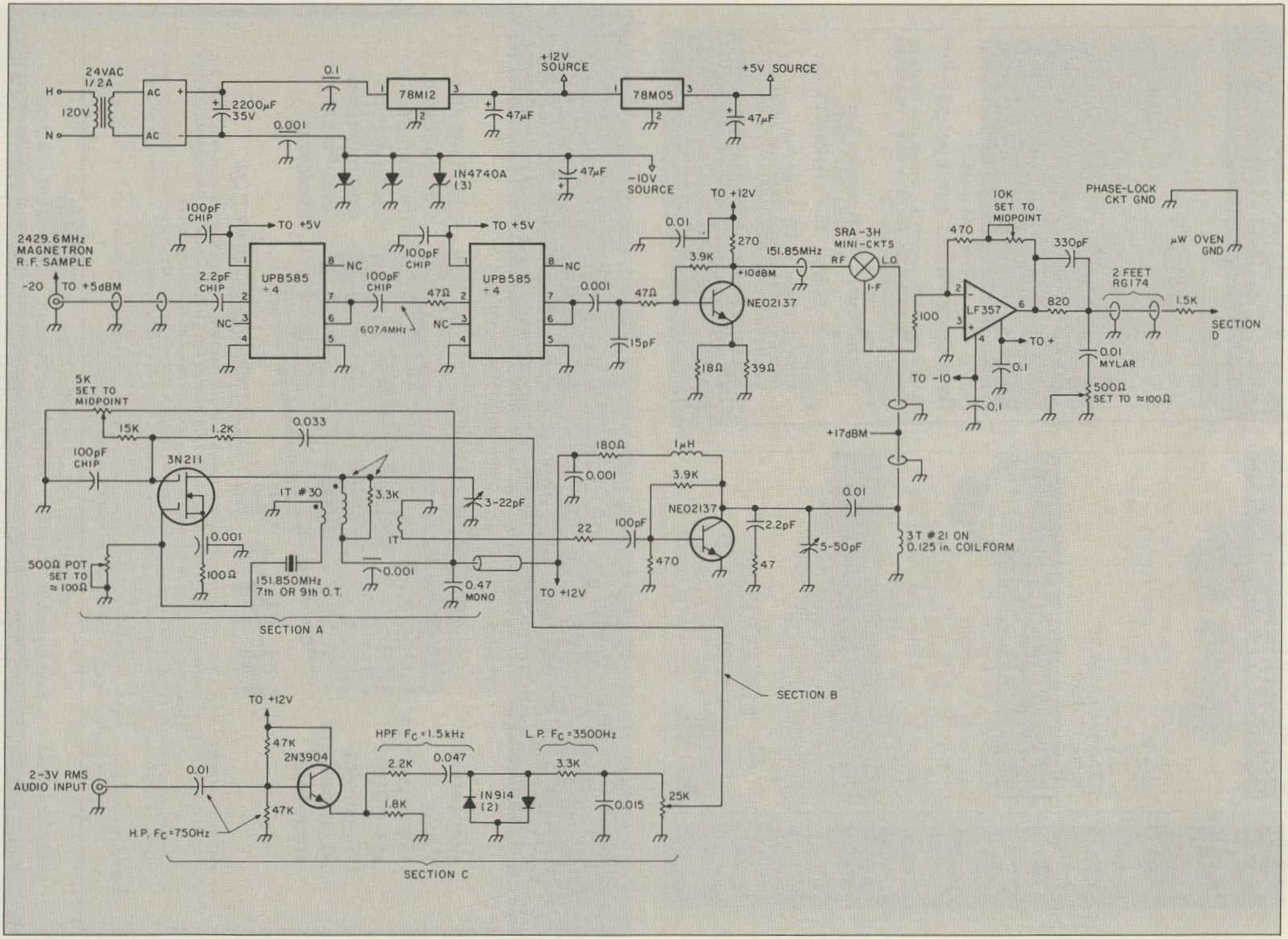

Figure 3. NBFM phase-lock system schematic.

(See Photo A). This is analogous to a coaxial or microstrip short, where wavefronts are reflected back with a 180 degree phase inversion. At a quarter guide wavelength from the short:

$$\lambda g = \frac{\lambda}{\sqrt{(\lambda/\lambda c)^2 - 1}}$$

where λc = 2X guide broadwall dimension.

The reflection is in phase with the incident wave from the magnetron, and an E-field probe (see Photo B) is inserted at this voltage maximum. Ordinarily, maximum power transfer occurs when this probe is $\lambda/4$ in length. Deliberately shortening the probe introduces a reactive mismatch at the magnetron output port. After an unknown number of degrees rotation within the feed structure (Matsushita would not provide tube data), this causes the magnetron to be pulled lower in frequency by some 25 MHz from its design frequency, ensuring legal amateur band operation.

Floating Operation

One important feature of this conversion is the modification of the high voltage power supply for floating operation. The original power transformer had one end of the secondary grounded to the frame. I lifted this end and attached it to a high-voltage lead wire. This modification eliminates the need to float the entire modulator above ground, which also requires video-bandwidth opto-isolators. Hi-pot tests at twice the rated voltage confirmed that the modification was reliable.

EME Anyone?

Narrow band FM (±5 kHz deviation) requires a clean RF source low in noise and incidental FM. You can use the phase-lock or frequency-lock loop, as shown in Figure 3, with the non-inverting input of U1 equivalent to the varactor control voltage in a conventional VCO.

The following notes discuss sections of the phase-lock circuit, and tell how to wire this circuit into the transmitter unit.

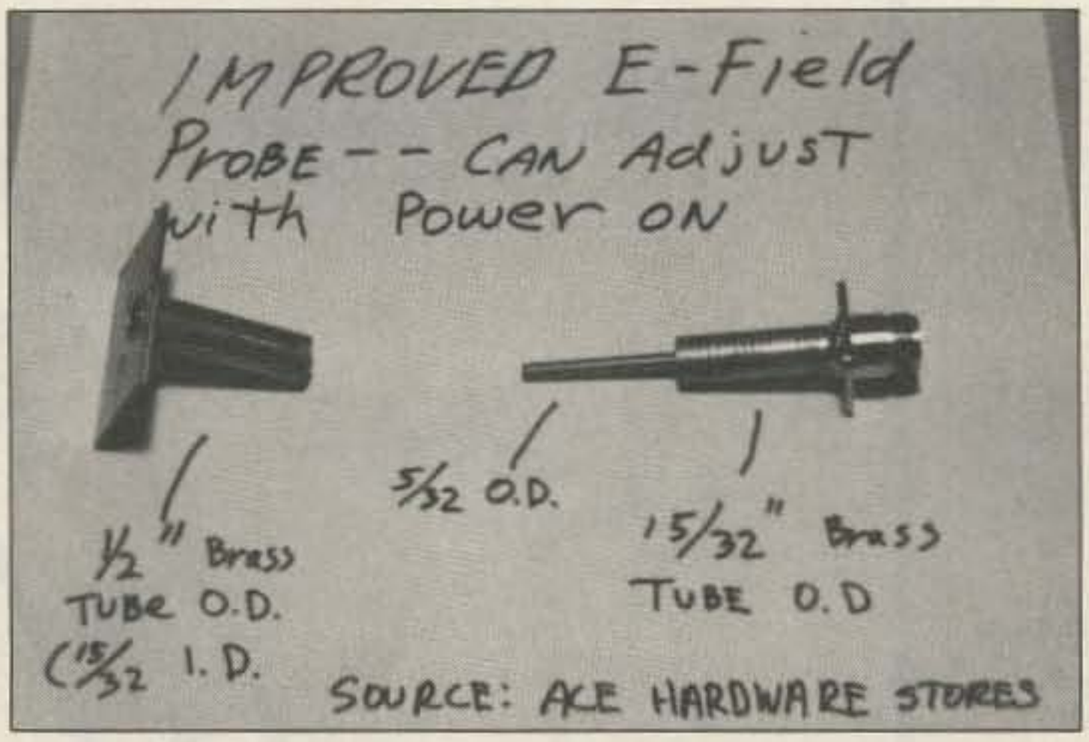

Photo B. E-field probe construction details.

Refer to Section A on the schematic—the overtone VXO circuit. The entire unit should be temperature controlled at 70°C by "crystal ovens," or something similar. The oscillator drifts at around 100 Hz per degree, causing about 1.6 kHz per degree for the frequency out drift. Stability is traded off for simplicity in this design.

Refer to the 151.85 MHz crystal in the VXO circuit. Choose this crystal after you build the oven video transmitter and measure the stable operating frequency range using one UBP585 and a 600 MHz counter.

Now refer to the crystal oscillator tank coils, to the upper right of the crystal on the schematic. You fabricate this by winding six turns of #24 wire on a 3.3 k ½W carbon resistor. Then, wind one turn of feedback winding, tightly coupled, and one turn of output winding, loosely coupled.

Now look at Section B, the connection between the VXO and the IOC. There is about 0.6V PEP for 300 Hz VXO deviation, which results in about 5 kHz of magnetron deviation. The VXO deviation is linear up to about ±10 kHz output (magnetron) deviation.

In Section C, the IOC is cheap 'n' dirty, but plenty effective. The *Handbook* has a better—and more complicated—version of this.

Finally, at Section D, find the two-foot lead of RG-174 that comes off pin 6 of the LF357 IC. Attach this to pin 2 of U1 in the transmitter circuit (Figure 2). Before doing this, however, be sure to remove the 4.5 MHz audio subcarrier at R8, and the video input.

You have now converted the microwave oven transmitter to use with NBFM (±5 kHz) voice mode! Now adjust the magnetron cavity probe length and R6 until the magnetron locks up at all times during the magnetron anode warmup (5–7 minutes).

Transmitter Improvements for NBFM

- Bypass D5 and D6–D17 with 0.0005 to 0.001 µF 3kV minimum caps. This reduces "hum bars" in the picture and low-level audio buzz in the NBFM mode.
- Isolate the metal case of the 0.74 µF (on T1) capacitor from ground with plastic blocks, nylon screws, or other means. This will also reduce hum bars and buzz.
- Using insulated standoffs, isolate T1 laminations, and frame from ground. This will further reduce hum bars and buzz, and will result in better insulation in T1 after mods.
- Disconnect the magnetron filament feedthrough from ground! Otherwise you won't get full video bandwidth, and the NBFM mode PLL filter won't work (no phase margin). See Photos C and D.

Performance

Spectrum analysis indicated the performance of the transmitter. The 1st Bessel null display (I_k = 160 mA, V_p = 3500V, Mod. index = 2.4, Mod. freq. = 1 MHz, and center freq. of 2.431 GHz) shows that the modulation is primarily FM.

Additional Comments and Observations

The following notes may or may not apply to the system if the NBFM phase-lock system is installed.

Warm-up drift is significant over the first ten minutes of operation, representing about

Photos C, D. Disconnecting the magetron filament feedthrough from ground. Drill out the rivets (Photo C) and push feedthrough 3/16" into sheet metal box of magnetron, and then epoxy in place (Photo D).

Photo E. Microwave leakage detector—a must for this project!

15% of the available tuning range (2.5 MHz).

Avoid magnetron "moding," appearing on a spectrum analyzer as a comb instead of a CW signal. This can be caused by a VSWR greater than 1.5:1, or by operation below about 50 mA. If low power operation is desired, raise the filament voltage to 3.4 – 3.6 V, since internal RF contributes to proper filament (cathode) temperature in normal operation.

If used with a true FM television receiver, such as a modified satellite TVRO unit, the simple pre-emphasis network shown on the schematic diagram will improve video S/N by up to 10 dB. Also, TVRO receivers use greater than 20 MHz IF bandwidth, greatly reducing the effects of warm-up drift.

Small "hum bars" are visible in the picture, due to the floating high voltage power supply. This effect is caused by the 60 Hz switching of the diodes, varying the capacitance to ground at the magnetron cathode. These transients are out of the control loop. Grounding the power supply and floating the modulator at high voltage is a solution, as is floating the magnetron and cavity. Either would increase circuit complexity and increase exposure to hazardous voltages.

As with any non-locked oscillator, a change in system load impedance will change the frequency of operation. A high power isolator is one solution, albeit an expensive one. I used a stretch line to measure the load pulling effects of a 1.5:1 VSWR over all phase angles. The frequency changed ±6 MHz as the phase angle varied. At the design frequency of 2430 MHz, all modulating products should remain within the amateur band. This is not a trivial problem, and may require line trimming or line stretchers to place the phase angle in a stable region. The lowest possible antenna VSWR is the best solution to the line-pulling problem.

Beware!

Remember, for this project, SAFETY IS PARAMOUNT! This transmitter has 4 kV DC and high power microwave energy present. Use a microwave leakage detector to check the integrity of the modified unit (see Photo E). You can buy an inexpensive detector suitable for the job. Also, retain the door interlocks (I installed the modulator in the now-unused cooking cavity.) Antennas can easily have high gain at this frequency—DO NOT POINT THEM AT PEOPLE OR OTHER LIVING BEINGS!

Although this is not a "high performance" television transmitter, it represents a low-cost effort to achieve significant power output at microwave frequencies.

Readers interested in finding out more about this project can contact the author for details, at *Creative Electronics Consultants, 1815 W. Higgins Road, Sleepy Hollow, IL 60118, Telephone: (312) 428-5676.* 73

Article materials, except the phase-lock system, were drawn from the March 1989 issue of RF Design.

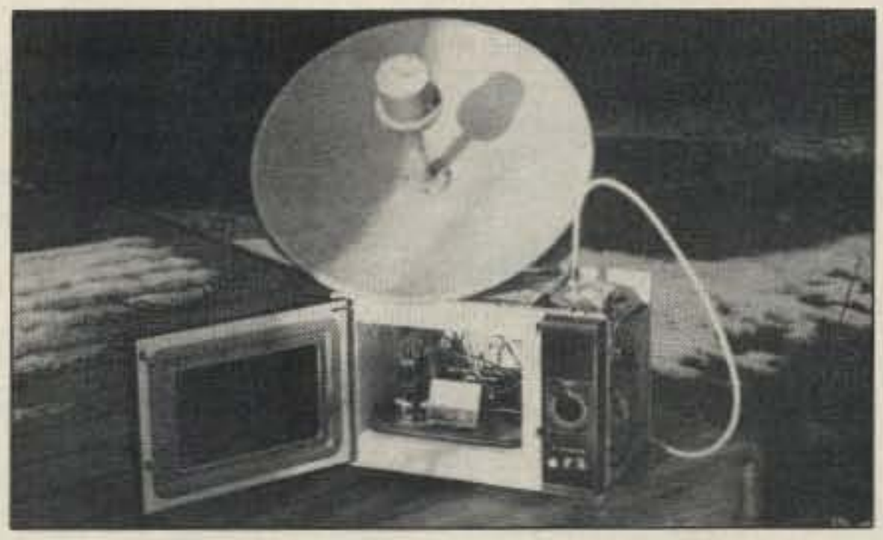

Photo F. The complete microwave oven ATV transmitter unit. The transmitter circuit is located in the oven's cooking chamber.

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AERIAL VIEW

Antenna News

Arliss Thompson W7XU
RR 3, Box 224
Sioux Falls SD 57106

Mobile HF Antenna Modification

This month's column describes a simple, easily-reversible modification to the standard Hustler mobile antenna that will yield a substantial (2 to 3 dB) improvement in its performance. HF mobile operators using other brands of antennas may be able to realize similar gains, depending on their design, by using the methods discussed here.

Mobile Antenna Limitations

By far the majority of HF mobile antennas are short vertical whips. The mobile environment places severe restrictions on antennas, foremost of those restrictions being a limitation in antenna size. To understand why short antennas are a handicap in mobile operation, you must first recall that the radiation resistance of a vertical antenna is proportional to its length. The shorter the antenna, the lower the radiation resistance.

A low value of radiation resistance in itself is not bad, but for any antenna to radiate efficiently, most of the applied power must be "dissipated" in the radiation resistance. An antenna with low radiation resistance will operate efficiently only if other losses are kept very low. Those other sources of loss include power lost in any loading coils, and power lost in the ground. Therefore, to radiate the strongest signal possible, the radiation resistance needs to be maximized while the coil and ground losses are held to a minimum.

At a home station, it is possible to build an efficient short vertical antenna by using a large number of ground wires to minimize ground losses, and using well-designed coils in order to keep coil losses at a minimum. In the mobile setting, however, coil size is limited by wind-loading, and there would seem to be little control of ground losses, which tend to be relatively high. Since the antennas used on vehicles tend to be quite short (in terms of wavelength) while ground and coil losses are fairly high, mobile antenna efficiency on the lower HF bands tends to be dismal. By dismal, I mean feeding 100 Watts of your 3.9 MHz signal into the antenna, but having only 5 (!) Watts radiated; the other 95 Watts heat the loading coil and the ground. What can we do to improve on that low efficiency? I'm glad you asked.

Making the Best of It

A few years ago, the ARRL published a book entitled *The ARRL Antenna Compendium, Vol. 1.* One of the articles in that book was "Optimum Design of Short Coil-loaded High-frequency Mobile Antennas," by Bruce Brown W6TWW. That article contained much good advice on mobile antenna installations (most of the information also occurs in the latest [15th] edition of *The ARRL Antenna Book*). His advice, in short, was to maximize radiation resistance and minimize coil and ground losses. He also provided some suggestions on how to carry out these recommendations.

Offhand, there would seem to be little a mobile operator could do to minimize ground losses short of driving his car into the surf on his next visit to the beach. Some experimentation by Mr. Brown, though, indicated that ground losses could be markedly reduced by mounting the antenna as high above ground as possible. That means, all else being equal, that mounting your antenna near the top of your vehicle will give better signal strength than if it's bumper-mounted.

As an example of the magnitude of that effect, he reported a ground resistance of 2.5Ω with the antenna mounted near the roof of a station wagon, but 6Ω when bumper-mounted on a mid-sized sedan. This change in ground resistance is further compounded by the lower radiation resistance of base-loaded antennas, compared to center-loaded verticals. Base-loading a bumper-mounted mobile antenna therefore results in reduced efficiency because losses are increased while radiation is simultaneously decreased.

Now consider coil losses. Here, the base-loaded antenna would seem to have an advantage over the center-loaded whip because it requires only half the value of coil inductance to attain system resonance than the center-loaded whip. However, if that coil is mounted near metallic surfaces, it is likely to have losses greater than anticipated. That is important to consider if you plan on bumper-mounting a base-loaded antenna.

It may come as a surprise to some, but loading coils manufactured for commercial antennas are not of optimum design. For greatest Q, and lowest losses, a loading coil's diameter should be twice its length. I doubt you've seen many mobile coils with that shape. The problem with optimally designed coils, of course, is wind-loading. It doesn't do much good to have an ultra-low loss coil for 75 meters when the thing won't stay in one piece on the road.

Another problem for those of us who try to make our own, more efficient, loading coils is that they can be difficult to protect from the weather. I have had commercially manufactured coils that were so severely detuned after driving all day in torrential rains that they were completely useless until brought in and dried out.

The same can happen, and often does, with coils you manufacture yourself. And, of course, there is also the mechanical problems associated with building your own coils and integrating them with other components. Therefore, all things considered, I decided to use stock Hustler coils (kW version) when attempting to modify the Hustler system.

Of the losses I mentioned earlier in this article, the one yet to be discussed is the power lost in the radiation resistance. Of course, this loss is desirable, since it represents radiated power. To maximize the transmitted (or received) signal, the radiation resistance needs to be maximized. The radiation resistance is proportional to the frequency and the length of the antenna, so we can increase our mobile antenna's efficiency by either going higher in frequency and/or making the antenna longer.

Longer is Better

Naturally, there are some limits as to just how long an antenna you can have while operating mobile, particularly if you mount the antenna high on your vehicle, but I felt that I could safely extend the length of my Hustler antenna and perhaps reap an increase in signal strength.

From a study of W6TWW's data and other information available in *The ARRL Antenna Book,* I estimated that by lengthening the mast section of the Hustler system by 36 inches, I would be able to obtain approximately 3 dB in increased signal strength. I arrived at those figures by first finding the loading coil reactance of an 8-foot antenna tuned to 3.9 MHz with the loading coil placed 4.5 feet above the base. True, although the Hustler resonator is mounted 4.5 feet above its base, the overall length is somewhat over 8 feet. Nevertheless, I assumed that the value I obtained would be somewhere in the ballpark, and proceeded with the analysis.

Alongside the data for the loading coil reactance for an 8-foot whip, was similar information for an 11-foot antenna. Since I planned to use the same coil (and therefore the same inductive loading reactance) for my modified antenna, I simply read from Brown's graph what height the loading coil should be above the base of an 11-foot antenna—approximately 7.5 feet, or 3 feet higher that the coil's original position.

The next step was to estimate what 3 extra feet in mast length would buy me. Mr. Brown provided some radiation efficiency data in his article that compared the efficiencies of 8- and 11-foot whips with various combinations of ground losses and coil Q. Study of those curves indicated that it should be possible to gain as much as 3 dB on the 75 meter phone band by going from an 8-foot to an 11-foot antenna, other factors being equal.

That value could also be obtained by comparing the differences in radiation resistance between 8- and 11-foot antennas ($RR = h^2/312$, where RR is radiation resistance in ohms, h is height in electrical degrees, and 312 is a constant). Three dB gain for the price of 3 feet of aluminum sounded good to me, so I found a section of tubing with the appropriate diameter and fitted it over the upper end of the Hustler mast with ample overlap for mechanical support. The extension tubing had a short lengthwise slit cut in the bottom end so that compression clamps could hold it in place on the Hustler mast. The far end of the tubing used for the extension was also slotted. Compression clamps held the shaft of a ⅜-24 bolt in place. The bolt was placed lengthwise in the tubing with threads exposed; it provided the

continued on p. 83

Number 18 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

Microwaves and Satellites

Hamsats complement this month's microwave topic. AMSAT-OSCAR-13 provides two modes for microwave Earth stations.

Mode L operates with an uplink centered on 1269.5 MHz and a downlink of 435.86 MHz. (A complete frequency chart is shown in the December 1988 Hamsats column.) The transponder, nearly 300 kHz wide, is activated for two hours per orbit whenever the satellite's antennas are aimed at the Earth's center. Stations running as little as 300 Watts effective radiated power (ERP) have made consistent CW contacts. Five Watts into a yagi with 18 dB gain works, but reliable SSB operation requires more power or a better uplink antenna.

Mode S, our newest satellite mode, uses 70 cm for the uplink and 13 cm for the downlink. The system was designed to perform successfully with 2.5 kW ERP on the uplink. Downlink signals were to be strong and equal to the telemetry beacon. Unfortunately, it hasn't been working out that way. In late April, Bill McCaa KØRZ offered an explanation of what is happening with the Mode S transponder.

The system was designed for two possible operational states. One is telemetry beacon ON and passband OFF, and the other is beacon OFF and passband ON. Due to what appears to be a component failure or wiring error, the command to activate the passband and turn off the beacon is not getting through from the main computer.

Contacts made via the S transponder are driving through a transistor switch that is biased off. During bench tests prior to launch, Bill discovered that signals could be forced through the passband while the beacon was on only when signal levels were increased by 20 dB. This uplink penalty means that to get a beacon-level downlink signal, an Earth station now needs over 200 kW ERP. This is a far cry from the 2.5 kW level originally anticipated, but all is not lost.

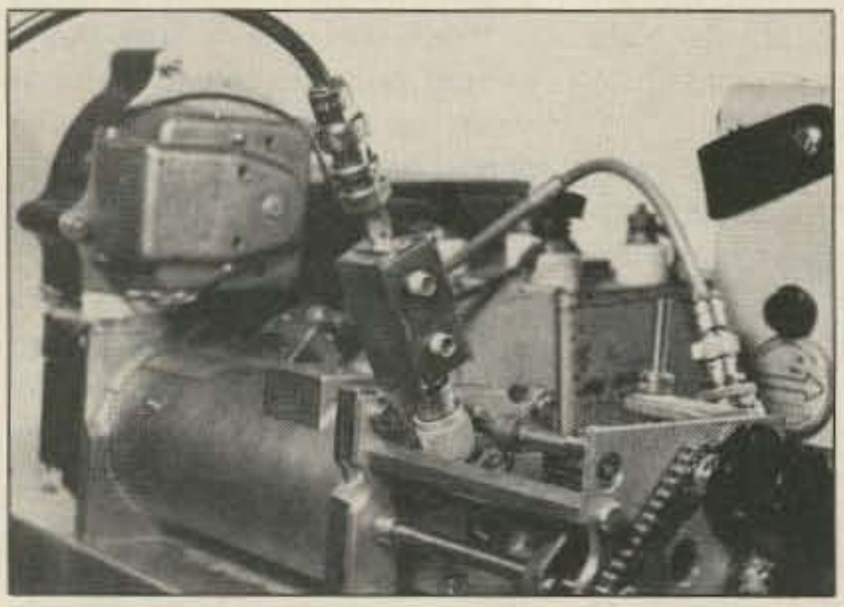

Photo A. Modified Adler 1.2 GHz amplifier ready for the Mode L 1269 MHz uplink.

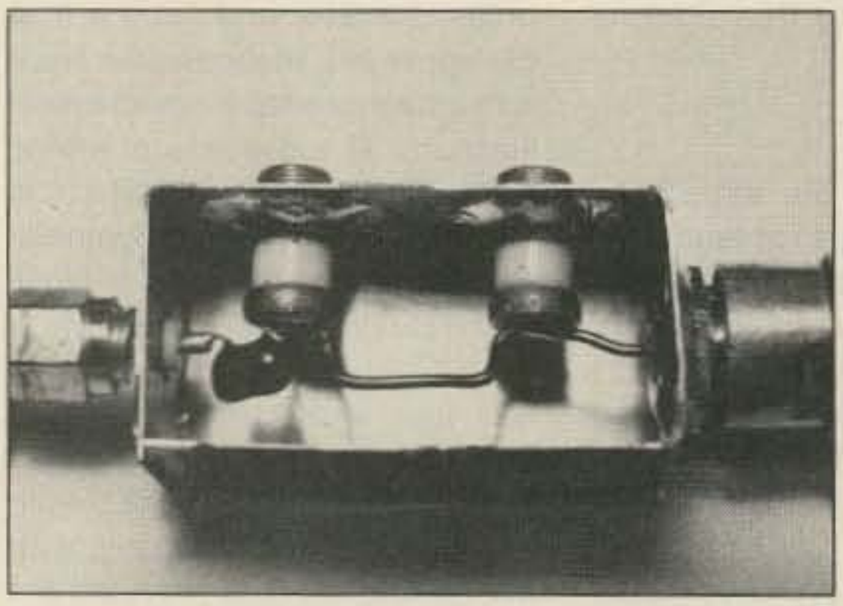

Photo B. Inside view of the new input tuning circuit.

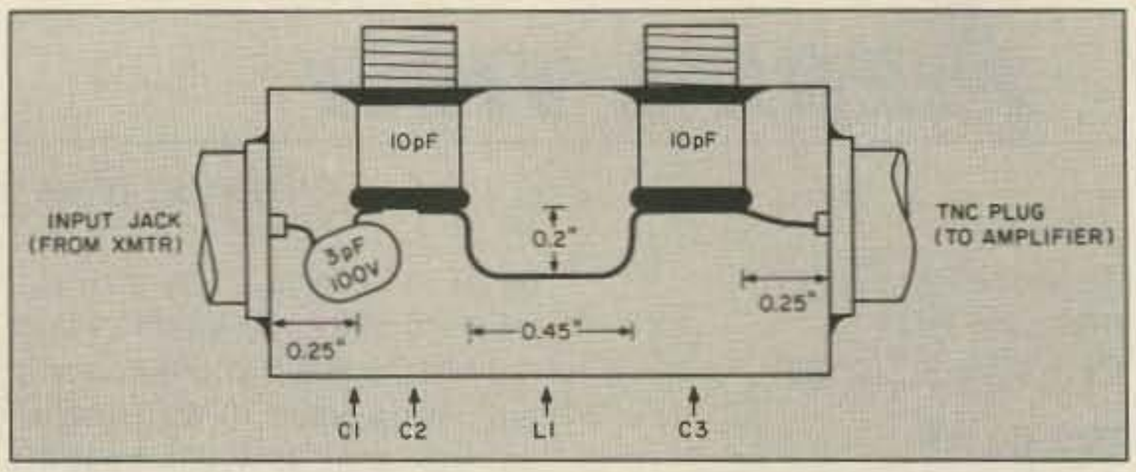

Figure 1. 1269 MHz amplifier input tuning assembly.

Although some operators are transmitting high power to a moonbounce antenna array, that's not the only way to work mode S. If the satellite's antennas are aimed your way, and you can operate CW with two to four kW ERP, it's worth a try. Signals will be exceptionally weak, but usable. John Molnar WA3ETD described some excellent "Mode S Receive Techniques" in the May 1989 Hamsats issue. The 2.4 GHz WB5LUA preamps that John mentioned are now available from Down East Microwave, Box 2310 RR1, Troy, Maine 04987.

Mode L Upgrades

In the October 1988 Hamsats column, I described my Mode L uplink system. It included eight Watts through 65 feet of Belden 9913 coax to a single 45-element loop yagi. My returns were weak and SSB contacts few, but it worked.

I wanted to improve this. I replaced the feedline with Andrews ⅞" Heliax and added a solid-state amplifier from Down East Microwave. The 65 foot run of 9913 had about 3.5 dB loss at 1269 MHz while the Heliax showed less than one dB loss. My net gain was 2.5 dB. The mplifier provided 33 Watts output for eight Watts in. Net gain was just over 6 dB. The total 8.5 dB increase in ERP has made CW contacts easy, and SSB contacts reliable–most of the time. Since my local deed restrictions do not allow dishes or large uplink arrays, I needed more power for further improvements.

Back to Tubes

In the October 1987 issue of *73*, Pete Putman KT2B described a commercial tube-type power amplifier suitable for 1296 MHz. (*73* sells back issues if you don't have October 1987 in your collection.) If you have one of these Adler amplifiers, congratulations! They are hard to come by, but occasionally they show up at swap fests.

The article, "Everyman's Microwave Amp," explained some very simple modifications to the cavity-style unit which would provide nearly 100 Watts output for 10 Watts in. Performance is excellent in the high end of our 23 cm band, but it drops dramatically at lower frequencies. At 1269.5 MHz (the Mode L uplink) the output is less than the input. The following modifications, forcing the unit to tune lower, solve the problem.

The first step is to remove the shims used in the original modification to increase the output cavity's size. The reason for this is that the amount of shimming necessary to get to 1269.5 MHz will make it impossible to hook up the input connector.

There are two rods that position the cavity plunger when tuning the output section. They need to be about one-half inch shorter. Remove the mechanical tuning assembly and unscrew the plunger rods. They are threaded on one end and accept screws on the other. Carefully cut off one-half inch from each rod at the female end. Re-drill the screw holes and rethread for 6-32 screws. The shorter rods allow the cavity plunger to bottom out before the tuning assembly has reached its end. Install the shortened plunger rods, but do not put the mechanical unit back in place yet.

The input circuit was originally

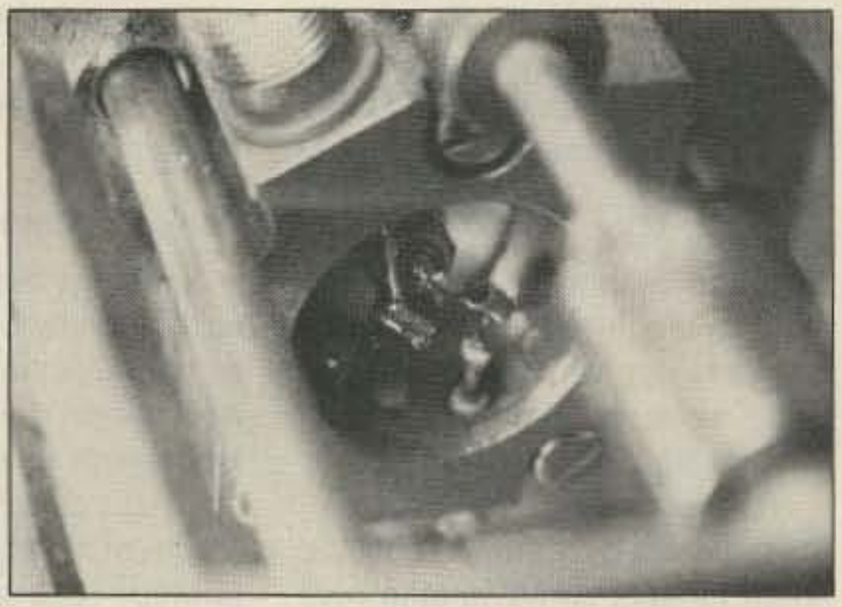

Photo C. Input and filament section of the Adler amplifier. Original LC network and resistor have been removed.

Continued on page 70

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D612	$259.95	50 Hz-1.2 GHz	0.1 PPM 20°-40°C PROPORTIONAL 10 MHz OVEN	9	15 to 50 MV	2 to 20 MV to 450 MHz 20 to 30 MV to 1 GHz	
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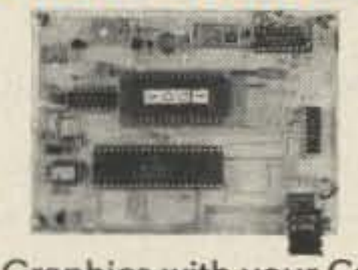

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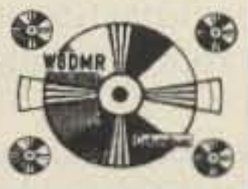

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73 Review

by Gordon West WB6NOA

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Microwave hilltoppers understand the importance of knowing EXACTLY where they are. With their antennas positioned just a few degrees off, they will never be able to contact each other. For microwave work, you not only need your exact position, but also an ultra-accurate way to determine bearing (magnetic or true) to that distant station. How many times have you been hilltopping and discovered you really didn't know where you were, and had absolutely no way of figuring out where that dirt road was where you parked your car?

Enter Fluxgate

One of a new breed of portable Loran-C receivers, and a fluxgate digital compass (see photo), solve these problems instantly. This whole affair weighs less than three pounds, and runs nicely from a flexible solar panel! (See sidebar for an explanation of Loran-C).

How They Work

Hand-held and portable digital fluxgate compasses are the latest rage among mariners and pilots. These electronic compasses do not use a conventional floating magnetic card. Rather, they sample the Earth's magnetic field referenced to a tiny ferrite bar inside the electronic compass assembly. A built-in computer then analyzes the phase differences between the magnetic variations, and gives you a magnetic readout accurate to better than one degree! Mount this on your 10 GHz horn, or microwave dish antenna system, and there's no question about the magnetic or true bearing you have your system aimed at! The digital readout is easy to see at a distance, and it's rock steady. It's back-lit for night viewing, and the entire assembly only draws about 150 mA.

Easy System Powering

Your hilltop portable radio position determination station would start with a small 12 volt power source. I use a Yuasa gell-cell that gives me 12 volts at 6 ampere hours. This can run my NAV station the better part of a day. Hooked to that battery is a Sovonics "Sun Pal" Model 110 solar panel system. The panel

About Loran-C

"Loran" stands for LOng RAnge Navigation. Our country and coastal waters are blanketed by 100 kHz radio signals from US government megawatt stations. You can easily hear the transmitting characteristics of your local Loran-C stations by tuning your general coverage ham receiver down to 100 kHz. The signal sounds like the drone of an airplane.

Loran-C stations are usually set out in groups called "stars," with one master station set in the center of the star, and two or more secondary stations arranged around the master, as points on the star.

Refer to Figure 1. The curve of all points having the same *difference* in distance to a pair of stations is called a Line Of Position (LOP). The intersection of two or more LOPs, shown in the figure by dashed and dotted lines, fixes receiver position.

A master station broadcasts a series of nine pulses, coded so the receiver can identify it as the master. Secondary station S1 waits a precise interval, and then broadcasts eight pulses. The difference in the time of arrival of these two groups of pulses—TD1—at any Loran receiver in the area determines which LOP the receiver lies along, as shown in Figure 1.1

S2, after a longer delay than S1, broadcasts its own eight pulses. The difference in arrival time between the Master and S2 signals—TD2—locates the receiver along a second LOP oriented in a different direction, as shown in Figure 1.2. Figure 1.3 shows the intersection of the two LOP curves. The intersection point is the receiver "fix." In many current Loran receivers, a computer calculates the fix and reads your location in latitude and longitude, or in time delay numbers superimposed on marine and aeronautical navigational charts.

Each group of Loran stations is identified by its Group Repetition Interval (GRI). The GRI is a four-digit number that is entered by the navigator when you wish to manually select chains.

There are enough Loran-C chains throughout the United States to provide you with excellent Loran-C radiolocation capabilities. All you need is a simple receiver with base-loaded whip antenna.

A high quality Loran receiver will track the Loran signals with a random error of about 1/10th of 1 microsecond (0.0000001 second). The effect of this error of position accuracy depends on where the set is with respect to the Loran station it is receiving signals from. Signal tracking error generally causes short-term random position errors from one hundred to five hundred feet. Loran accuracy using latitude and longitude is usually better than one-quarter mile! Loran accuracy using charted TDs (Time Difference) is usually better than a few hundred feet. Position repeatability, using ground wave signals during daylight hours, is usually better than an incredible fifty feet!

Loran Users

Most Loran use is from commercial and recreational mariners that ply our coastal waterways. Many mariners are extremely untechnical, yet they adapt easily to calculating their location using Loran TD readouts and their local nautical chart. Aviation Loran receivers are now quite popular, and many pilots, as well as mariners, navigate from one point to another using the Loran's "waypoint" feature.

You simply key in the distant waypoint, and the Loran computer determines the line-of-sight bearing to that distant waypoint, either magnetic or true. Pilots and mariners head for that distant waypoint and let the Loran update them for their estimated time of arrival, their speed over land, and the amount of error off the desired heading course.

If you have questions on Loran-C, write or phone the Chief Aids to Navigation Branch, at the district office near you, or at *Loran-C Education and Information Project, US Coast Guard Headquarters (G-NRN/TP14), Washington DC 20593. Tel. (202) 472-5857.*

measures 18¼" x 12¼" x 3.3" when folded, and generates almost an amp of power on a clear, bright day. It's flexible and fits nicely in a backpack. It will actually run my ICOM 02AT full power out, on transmit, with no battery connected!

Loran Receivers

A Loran receiver draws approximately 1 amp at 12 volts DC. Loran receivers are easy to buy by mail order. All mail order marine electronic companies sell inexpensive Loran sets. (See address above.)

Don't spend more than $600 for a Loran set unless you have a boat or an airplane, and you plan to use all of the advanced way-point features these more expensive sets offer. Many West Coast hams, getting into Loran for the first time, start out with the E&B "ASB 2001 Sea Ranger" Loran, a good performer. It comes with a base-loaded preamplified antenna assembly using coax as the feed. Simply screw any type of whip into the ⅜" twenty-four threads and you have a terrific antenna system. Even twenty feet of wire works well.

Good grounding techniques lower the 100 kHz noise floor and allow your unit to pick up more distant Loran chains. Experiment with the whip to come up with the best combination for a good signal. All Loran sets offer a signal-to-noise ratio display that allows you to play around with the antenna and ground connections. All indicators on a Loran unit are visual.

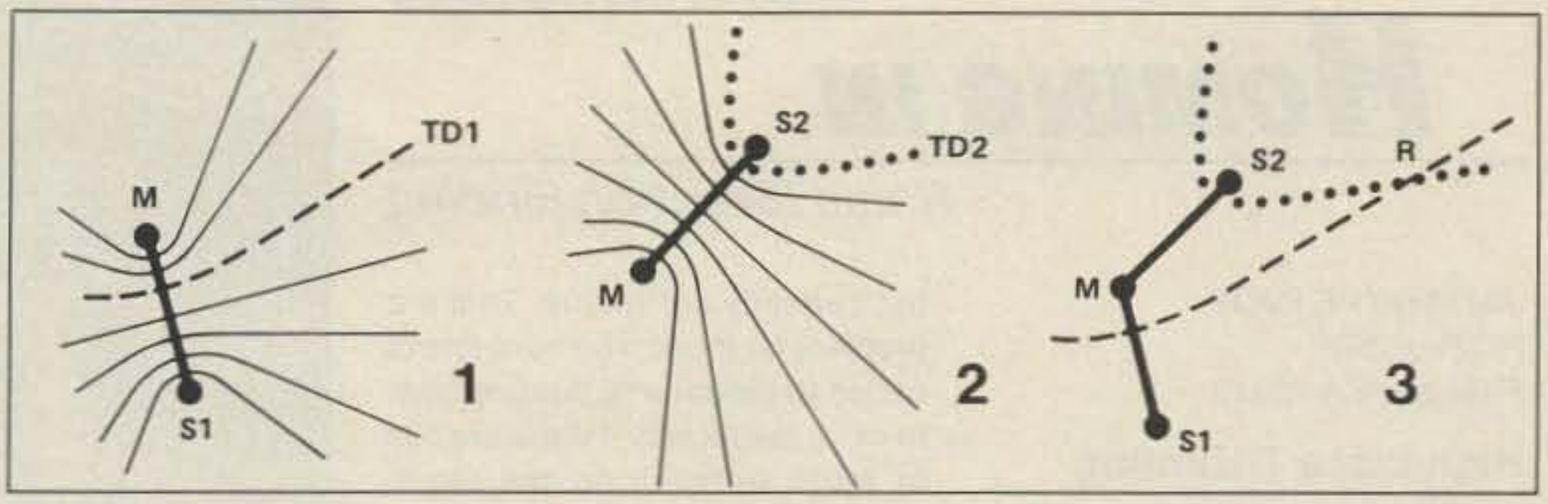

Figure 1. Diagrams of a Loran "star" group, that supplement the description in the sidebar.

The digital fluxgate compasses may also be hand-held, and they are available for approximately $125, manufactured by Autohelm (also found in the E&B catalog). I prefer a larger fluxgate compass, and I use the KVH Industries' Azimuth 100 compass that mounts directly on my 4-foot 10 GHz dish antenna setup. It has a memory function that also allows me to recall previous dish headings.

Portable and Fast

All of this equipment fits nicely in a backpack. You can trudge to the mountaintop with your hands free to carry the rig and your antenna assembly. It takes the typical Loran set approximately five minutes to acquire the signals, analyze the time delays, and begin reading out your position. Once the Loran set is locked onto your local chain, position updates take place several times a second. Your digital compass is an instant-on affair—turn it on, swing to the desired magnetic direction, and rest assured that that's the way to the other station!

Bring along some topographic charts. Find a marine or aeronautical chart with the printed Loran lines of position to further verify time delay readings. Calculate ahead of time the intersection of grid squares to find a hilltop that allows you to go from one grid to another.

The Loran system of today (Loran-C) is a dramatic improvement over the old Loran-A system of years ago. Loran is designated in the official navigational plan and is listed as one of the most accurate systems available for mariners, aviators, trackers, and hikers. There's no reason we shouldn't be using it, too, thanks to the low cost and availability of some very smart Loran sets and digital compasses. This gear will definitely give you a new "direction" on hilltopping. 73

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Come to the starting point of a transmitter hunt any weekend in southern California, and you'll see a line-up of eager contestants. Most of them have vans, trucks, or 4-wheel drive runabouts, with a beam or quad on a mast sticking up through a hole in the roof.

Active T-hunters are just like other hams who are serious about their special interests. We all know that serious DX chasers go to great pains to assemble their stations with state of the art rigs and ambitious antenna arrays. The contesters take care to lay out their equipment for efficient, easy-to-use operation. Likewise, successful T-hunters equip themselves with an array of well-functioning gear that gives reliable performance, set up to minimize errors and lost time in the heat of battle.

Photo C. The mast comes down through a trap door in the Astro roof console. The 4½-inch handle of PVC pipe allows lots of beam swinging without blisters.

Outfitting for Mobility

Our "All Day" hunts, held several times a year, are the ultimate test for DFers, who may spend all day and then all night looking for a hidden T that could be 200 or more air miles from the starting point. Many All-Day hunt devotees prefer 4-wheel drive vehicles, such as Broncos and Blazers for their mountain-goat traction. Others are partial to trucks, big or small, because of their power and ruggedness.

Trucks and 4X4s are nimble, but certainly not roomy. That's a problem for those who have lots of radios to mount and hunting gear to carry, especially if there are two or more persons on the team. More and more hunters are finding that a good solution to the space problem is a van. Full-size vans and minivans built on a truck chassis (such as the GM Astro and Safari) are plenty rugged. They take to the boonies well because of their high ground clearance. Be sure to get the nonslip differential, heavy duty electrical system, and extra large gas tank options!

When April WA6OPS and I got an 8-passenger van for T-hunting (we sometimes have lots of ride-alongs), it was easy to decide how to swing the various rotatable antennas. For us, a through-the-roof mount was the only way to go. The driver, the front-seat navigator, and even a mid-seat passenger can turn the mast. No one gets wet or cold reaching out an open window in the rain. There are no worries about getting ticketed for excessive antenna overhang. The 5 X 8½ foot roof provides a large enough platform for simultaneous operation of a Doppler DF and a quad.

Just like every ham shack, every hunter's setup is unique in some way. We carefully planned our T-hunt setup to meet our needs, but it would certainly work well for any active VHF T-hunter. Take a "systems approach" as you plan your own installation. Look at all the types of hunts you may want to tackle and all the equipment you may want to add. Then plan ahead.

Turning the Antenna

Once you set aside the natural reluctance to drill a big hole in your shiny rooftop, the rest is easy. The bushing (see Photo A) is two PVC plumbing fittings, a 1¼- to 1½-inch threaded reducer on top, and a 1¼-inch threaded-to-slip adapter screwed into it from the bottom through a 1-11/16-inch roof hole. Grind down any fillet on the shoulder of the lower piece so it seats properly.

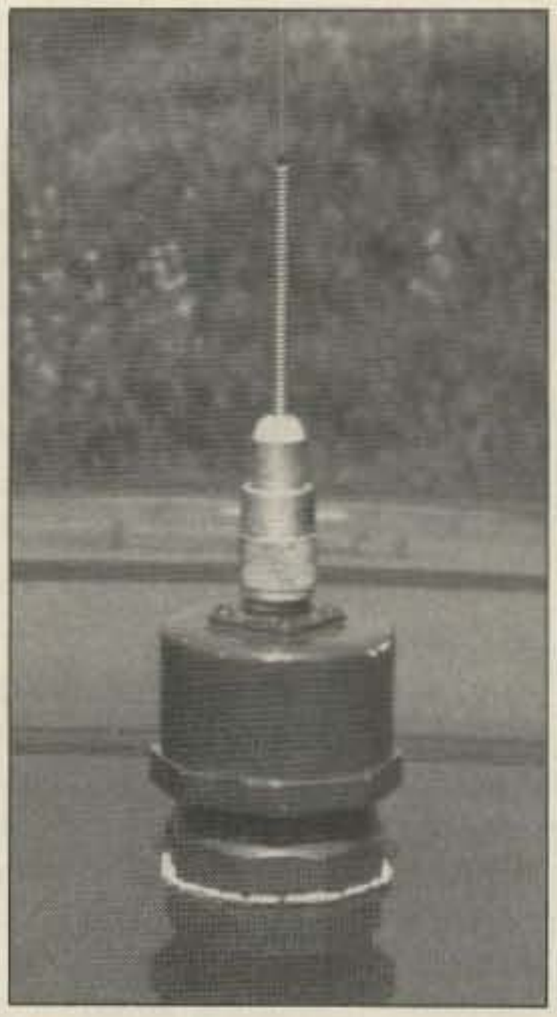

Photo A. When not in use for hunting, the roof hole bushing has a PVC cap. It makes a convenient mount for an extra whip antenna.

Photo B. It's not beautiful, but the plunger/rain deflector does the job, and you can move it from mast to mast.

PVC fittings have pipe threads, so they aren't designed to screw all the way into one another. You'll have to shave down the thread of the lower piece with a triangular file until it goes all the way into the top piece and the assembly doesn't rotate inside the roof hole. Don't force the fittings, or they'll crack.

Put some silicone seal around the roof hole and use a homemade gasket of tire patch rubber to waterproof the bushing installation. When not hunting, cover the hole with a 1½-inch pipe cap. You could mount an extra whip antenna on it, like the scanner antenna in the photo. When hunting, a bathroom plunger, which friction-fits on the antenna mast, keeps rain from running down inside (see Photo B).

Photo C shows the mast coming down into the van interior through the roof console. When you close the trap door after the hunt is over and the mast is removed, the bushing is out of sight. Unfortunately, the GM roof console includes a factory-installed corrugated steel support member that is difficult to drill through. It took a 2⅛-inch rotary hole saw and lots of patience.

Also visible in Photo C is an aircraft compass, mounted to the roof console and turned toward the driver at an exact 14.7 degree angle. That makes it easier to read, but more important, it automatically corrects for the magnetic declination in southern California. The canted compass indicates vehicle heading relative to true north instead of magnetic north, saving valuable plotting time.

The upper section of the antenna mast is ¾-inch Schedule 40 PVC pipe, slotted for exit of the coax where it joins the tee handle.

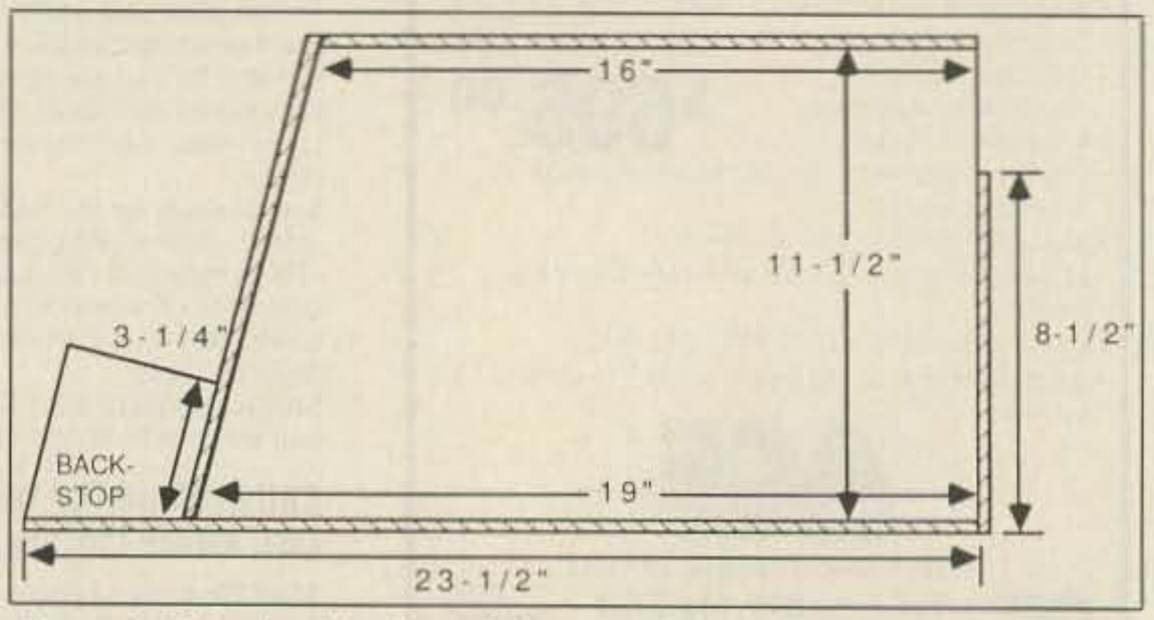

Figure 1. Driver's side view of the console box. Wood screws (#8 X 1½ inches) hold the top, bottom, back, and sloping front into the two trapezoidal pieces.

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I have built several rotary antennas, including quads and yagis for various VHF bands, each with its own upper section. It's easy to take a piece of PVC pipe, cut it, slot it, and drill it to make an upper mast for any new experimental antenna.

The lower mast section, including the tee handle for easy turning, is used with all rotary antennas. It's made with thin wall (Class 125) ¾-inch PVC pipe with a broom handle inside for strength and rigidity. A pair of 8-32 X 2 inch bolts and wing nuts securely fasten the two mast sections together, making it easy to set up and take down. The rounded bottom end of the broom handle turns freely inside a cup made from a 1-inch PVC pipe cap and 1-inch slip fitting glued together with PVC glue. The receptacle mounts flush inside the console box (see Photo D).

For accurate bearings, there's a 360-degree protractor around the hole and a pointer on the mast. I cut the head off a size 8d box nail, mounted it into the electric drill chuck, and drove it into a 7/64-inch hole in the mast (pointed end out) for a tight fit. A small light bulb attached to the attenuator shines on the protractor for night hunting. To get a beam heading on the fly, read the pointer indication and the compass indication in degrees, then add them. Subtract 360 degrees if the result is over 360. The result is a "true bearing," that is, a bearing relative to True North.

The Custom Console

I'm no woodworking expert, but the console box is simple enough to be within even my limited carpentry abilities. I made it from a single eight-foot plank of ⅝-inch thick particle board shelving, 11½ inches wide. There are two trapezoidal pieces, cut as shown in Figure 1 to form the left and right sides. The remainder of the plank is cut to form the top, bottom, back, and sloping front, all of which bolted into the edges of the side panels.

The rear panel goes only part way up, to give access to the interior. A heavy duty fabric belt holds just about any large or small transceiver securely in place on the front. Photo D shows 2 meter and 1¼ meter transceivers stacked. You can swap rigs for hunting on other bands in just seconds.

The console top holds important accessories, such as the attenuator and low-noise RF preamp, all of which use type BNC RF connectors for rapid reconfigurations. All items are secured with Velcro™ strips. Hidden behind the seat back in the photo are holsters for handi-talkies, made from plastic drink holders. There's even a charger to keep the HT batteries topped off. The inside of the console box has lots of room to store miscellaneous hunting necessities, such as protractor, compass, HT batteries, and maps.

I thought I'd have to bolt the console box to the floor or the seats to keep it from sliding around, but it hugs the carpet so well that it wasn't necessary. Not having to unbolt it makes it easy to move it out of the way for engine servicing. If yours slips, drive nails through the bottom board so that they protrude a quarter inch or so into the carpet.

Thanks to everyone who has written with their comments on "Homing In." I'm eager to hear more about your area's T-hunts. Next month we'll have a noise meter project for hunting very weak signals. 73

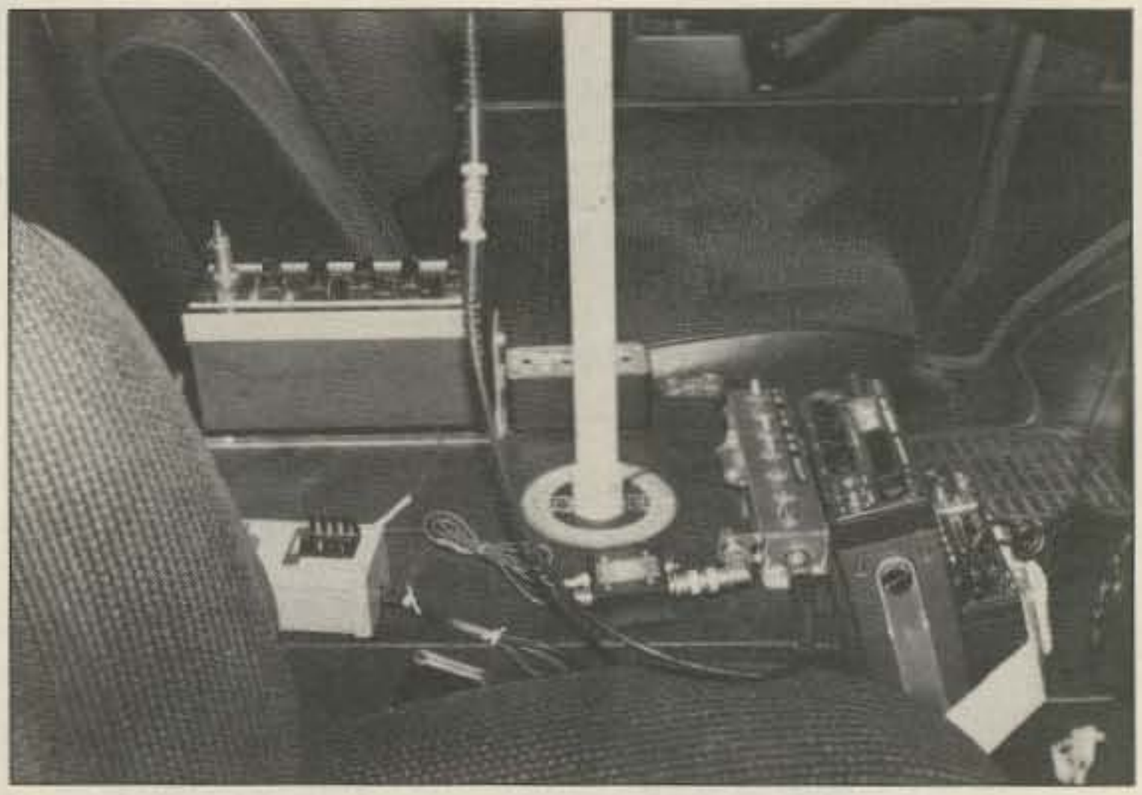

Photo D. The home-built console holds one or more transceivers of any size on its sloping front, along with the bearing indicator, attenuator, preamp, and HT battery charger.

HAMSATS, Continued from page 64

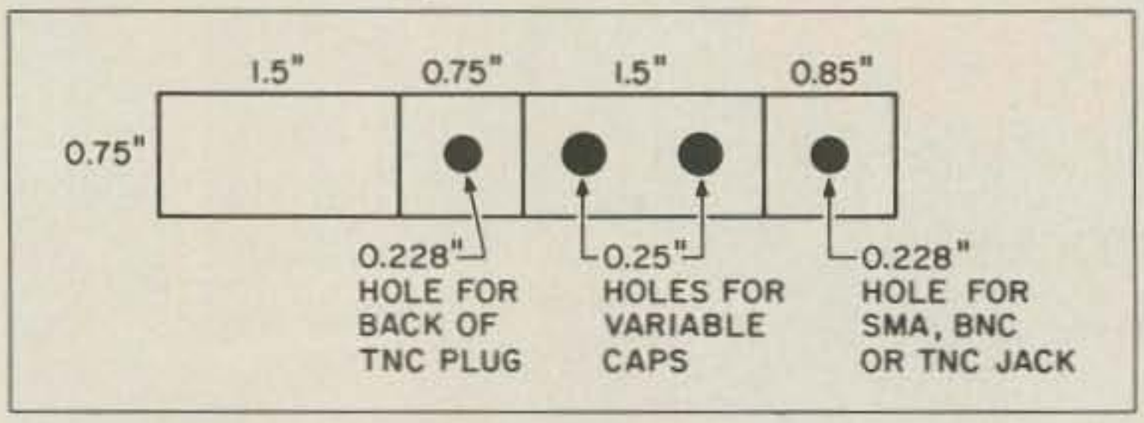

Figure 2. 1269 MHz amplifier input tuning box construction.

designed for frequencies above 1.3 GHz. This circuit will do fine at 1296, but it doesn't even come close at 1269.5 MHz. It includes a capacitor wrapped with a coil, and a resistor. Remove them and replace the capacitor/coil combination with a piece of wire. Be careful not to damage the socket assembly or the RFC chokes (the three to six loops of wire on the filament lines).

Reinstall the mechanical tuning assembly. The basic amplifier modifications are now complete.

Pete's article mentioned a "line stretcher" that he used to match the 50Ω output of his exciter to the tube's input. If you have one of these, you are ready for microwave DX via satellite. If you don't, here are instructions for a simple matching network which can be built with only a few parts.

Constructing a Matching Network

Photo A shows an input matcher mounted via the TNC jack on the amplifier. Photo B shows its internal wiring, while Figures 1 and 2 define construction dimensions and parts placement. The design was derived from the 1.2 GHz amplifier project in *The ARRL Handbook*.

When using a strong 3CX100A5 or 2C39WA, output will be between 70 and 80 Watts. The output cavity is at its maximum possible dimension with no room for further tweaking. This precludes any operation in the lowest portion of the 23 cm band, but this cost-effective amplifier can add several dB to your uplink signal and provide easy SSB and CW contacts in all situations. Remember to tune it first at low power levels.

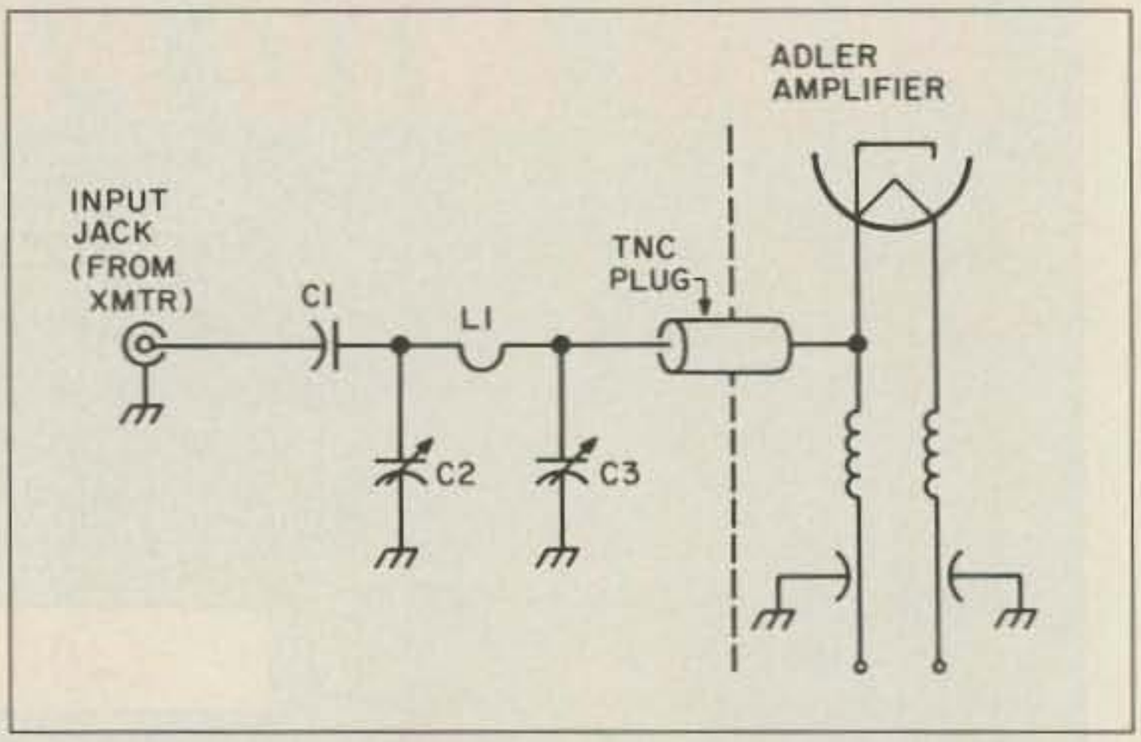

Figure 3. Schematic of modified 1269 MHz input network.

Dish Notes

For those of you who can install a dish antenna without antagonizing anyone, the "Inexpensive Mode-L Dish Antenna," an article by Keith Berglund WB5ZDP in the May 1989 issue of *73* can provide a fast way to a better uplink.

When building the dish from the article, note that Figure 2 of that article on page 18 calls for a one-inch floor flange on both sides of the antenna hub. The flange going to the feed assembly should be 0.75 inch or even 0.5 inch. It doesn't take much to support the can-type feedhorn.

The feedhorn drawing in Figure 4 of Keith's article does not show the distance from the back of the can to the center of the N-type panel connectors. Set this distance to 3.2 inches. Refer to the cover photo of the May issue for feedhorn mounting details and enjoy a fine home-brew dish antenna. 73

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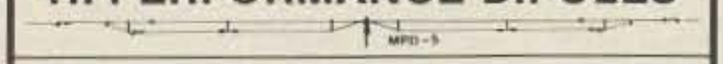

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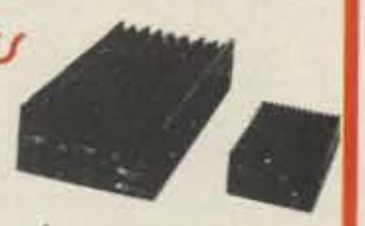

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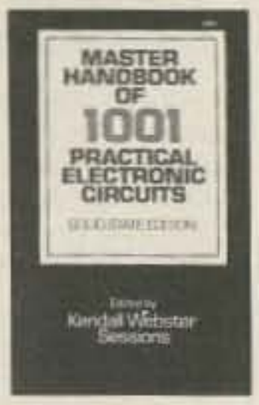

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Coaxial Connectors

There are many different types of connectors in use today for amateur applications, plus various military and space applications. Hams use different frequency spectrums, so they need several types of connectors. Choosing the correct connector can be confusing.

PL-259 (UHF)

The most common type of connector used today is the UHF or PL-259 connector, intended for larger cables such as RG-8. You will find it on high frequency transceivers, and on a lot of the VHF/UHF commercial transceivers in production. This connector was used in a lot of military equipment until it was dropped during the early 1960s. It's still used in amateur radio equipment, mainly because it's relatively inexpensive: about $1 each for the chassis or cable connector.

The UHF connector is not weatherproof and does not exhibit a normalized impedance through the connector. By "normalized impedance," I mean that the ratio of the inner pin to the outer shell size is constant and conforms to a standard design impedance, producing a low SWR through the connector. At frequencies up to about 200 MHz this is of little concern, if you're not fussy. You can use it at slightly higher frequencies, but I don't recommend this. The maximum peak voltage rating for the UHF connector is 500 volts.

You can use the UHF connector with RG-58 and RG-59 cables if you screw an adapter for the smaller coaxial cables into the rear of the PL-259. Without this adapter, the PL-259 (UHF) connector must be used with RG-8 cables directly. The UHF connector is a versatile connector, but keep in mind that it is not a good performer at VHF/UHF frequencies. It's ironic that it's called a UHF connector but really can't be used there! The UHF connector goes in the same category as the RCA phono and similar connectors: They connect cable ends together but give attention to little else. At high frequencies (30 MHz) this is just a small problem, but at 300 to 500 MHz the UHF connector's performance is marginal.

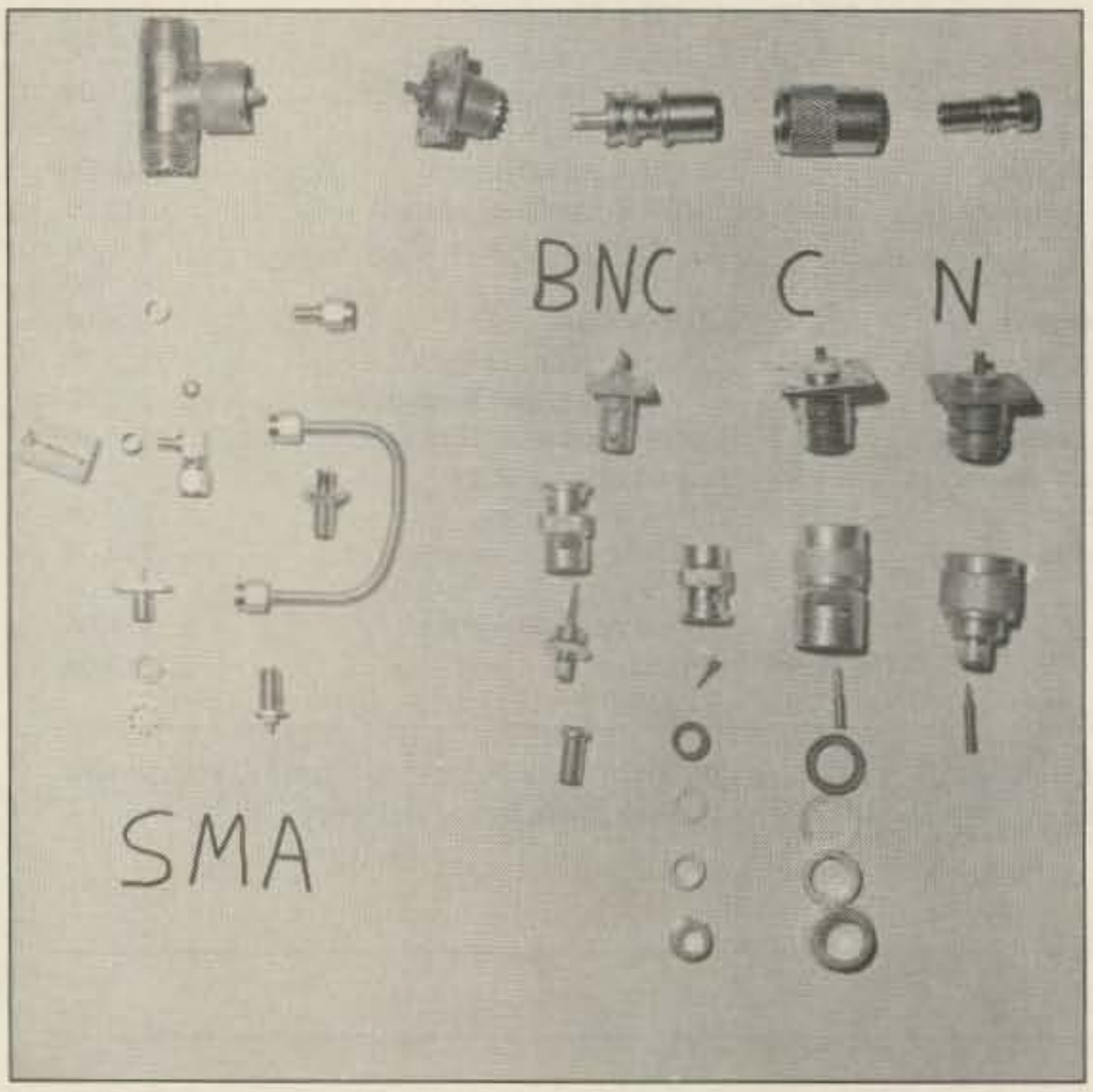

Photo A. Connectors. Across the top are the UHF PL-259 connectors. The small cable adapter is at the far right top. The N connector is a crimp on type, while the C connector is an older style, manually-assembled connector. The right BNC connector is a manual assembly, while the left BNC is a crimp type.

The SMA connectors are on the left. They are shown with the other connectors to compare size. The table gives additional information on some of the most used connectors.

BNC/TNC

The next most widely used connector in amateur applications is the BNC connector, most familiar on 2 meter HTs. This connector is one of the early designs that's good to 10,000 MHz. Currently, it's not really used above 3 GHz in most applications, but this is due to operator preference rather than to connector limitations. The BNC connector shields the inner conductor well, using beryllium copper fingers that make good contact between the mating connector shields. This advantage, combined with its quick-disconnect snap-on twist operation, makes the BNC a very good connector.

The BNC is rated for a standard impedance of 50Ω and 500 RMS volts peak.

There is also a screw-in type that is very similar to the BNC, called TNC for "threaded type of connector," that is useful where there's high vibration. The BNC and its cousin the TNC are identical in almost all respects, keeping in mind that the BNC is twist-on and the TNC is threaded on. (The BNC and the TNC will not mate with each other). Most of the military surplus equipment available has BNC, rather than TNC, fittings.

The BNC type of connectors make up the bulk of medium coaxial cable connectors in amateur use. BNC connectors are used on RG-58 (50Ω), RG-59 (75Ω), and similar size cables. Loss factors on either of the two cables aren't very good on frequencies above 50 MHz. I use the BNC connectors at 10 GHz but adapt them to use 0.141" hardline or semi-rigid coax to keep loss very low. Most applications with RG-58 or 59 is restricted to short lengths of cable where cable loss is not too important. Short runs in mobile applications are where these cables shine as they can be routed in small channels to hide the cable run.

Type N/Type C

A very popular connector favored by the UHF operator is the type "N" connector. The type N connector is truly a weatherproof connector and may be used outside. (Weatherproof or not, it's a good idea to wrap outside connections with a layer of rubber tape, and cover them with a layer of good electrical tape.) The N connector features a high peak voltage rating of 1500 volts and provides a true constant impedance through the connector.

The N connector is a threaded connector and is intended for use with larger cables like RG-8. There is a type "C" connector which is identical in all respects to the N connector, except that it is a twist snap-on. The C connector is made for the larger coax cables like RG-8. Both the N and C versions are weatherproof and are specified to 12.4 GHz. The two types are equal in performance, but the type N has found its way into more equipment and is far more popular than the type C. The type N is found on a lot of commercial test equipment, attesting to its excellent use at microwave frequencies. N and C connectors cost new about $4–7 each; the chassis mating connector is $2.75. The N connector is easily available in the surplus market and at swap meets.

Please note that with these connectors you can specify a type N connector in either 50Ω or 75Ω. (There is no such specification with the PL-259 connector; one size fits all types.) This can cause a problem if you're buying surplus parts: The 50Ω N connectors will not mate with the 75Ω N connectors. You won't see the difference at first glance, but look closer. The 50Ω connectors have a slightly larger center pin diameter than the 75Ω N connector. Look carefully and be sure of what you have!

I have more equipment in my ham shack that uses the N connector than I can count. Almost all test equipment has the 50Ω connector (unless it's intended for the TV industry, which specifies 75Ω).

Almost all of the projects in recent publications using larger connectors have selected the type N connector. This popularity stems from the constant impedance and applications with larger low loss coaxial cables in use at frequencies from 450 MHz and up. The N connector really shines in use with preamplifiers and such. Most of the newer GaAsFET designs have been shown using the N type connector in frequencies below 5 GHz.

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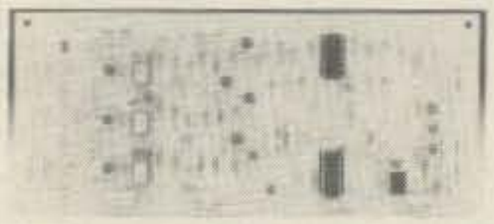

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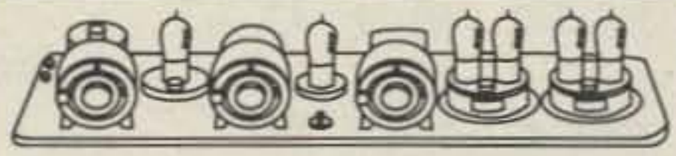

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SCANNER/TV version 60-800MHz RX only, 8db loss,"F" connectors.
WPO-TV $49.95

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RFTR-M for VHF MARINE $99.95

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MEDFORD, NY 11763
(516) 764-9798

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Designed with **angled** rear shelf for your viewing comfort and ease of operation.

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CIRCLE 268 ON READER SERVICE CARD

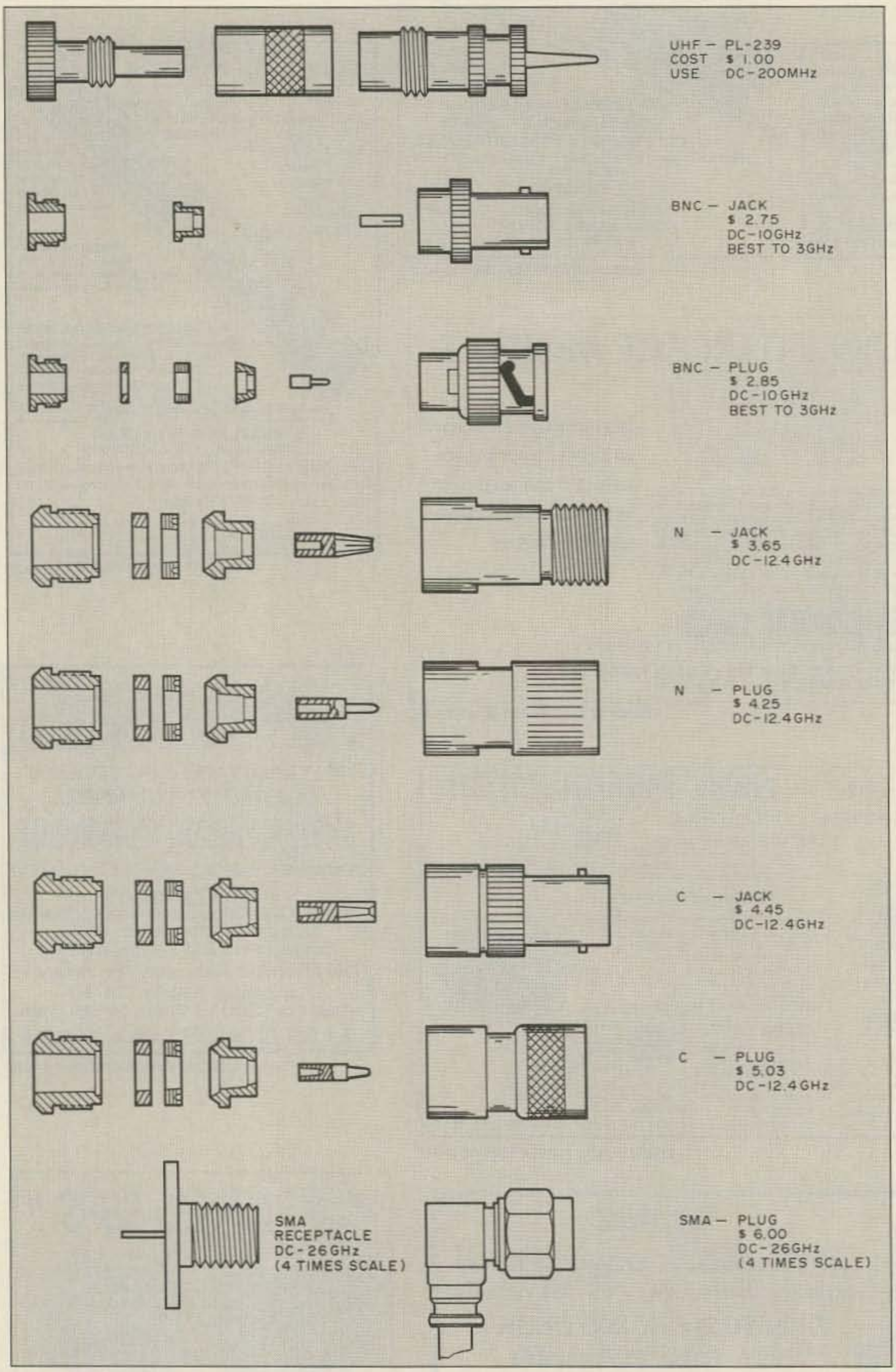

Figure 1. Comparison of popular cable connectors.

setting up equipment to do weak signal work on frequencies of 220 MHz and up, you will appreciate using a connector that gives constant impedance and low loss, with minimum SWR through each connection.

SMA Type

Fourth in popularity is the small miniature SMA connector. By "miniature," I mean a connector that is smaller than the BNC, which is classified as medium. The SMA connectors are coming of age in amateur circles. Industry-wide, the switch to miniature connectors took place quite some time ago. The SMA connector is rated from DC to 26 GHz, making it quite versatile in its application. Additionally, this connector provides a constant impedance through the coaxial connection. I favor the SMA connector and use it in most of the projects on my workbench. Since it's miniature, the SMA can't be used for very high power applications. Limit its use to 50 Watts at the higher microwave frequencies.

This connector shines in small receiving preamplifier and filter applications. Without a connector that will give constant impedance through its connection, you would get an impedance bump causing SWR discontinuity. This discontinuity is very pronounced at microwave frequencies because the size of the connector begins to become a sizable fraction of a wavelength. The SMC connector is quite small, less than ¼ inch in diameter, and is intended for use with miniature coaxial cables as well as with miniature rigid-type cables.

"Consider that most amateurs keep a feedline and antenna system ten years or more . . . Spend a little extra and your connectors and feedline won't let you down."

Most microwave applications specify use with rigid coaxial cables because loss is minimal when using short lengths: You are not concerned with 10 inches or 10 feet of cable at 30 MHz as loss is relatively unimportant in such a short length. As you increase frequency, the length and distributed capacitance and other factors also increase the loss of the cable. For instance, at 10,000 MHz (10 GHz) a 10-inch piece of braided Teflon™ cable showed a loss of 10 dB.

Replacing the braided Teflon cable (using SMA connectors) with a 10-inch piece of semi-rigid (hardline) cable 0.141 inches in diameter reduced the loss to something under 0.3 dB. You wouldn't use this type of cable to make long runs at microwave frequencies, but it's ideal for tying all parts of our microwave projects together. The heavy use of the SMA connector in both industry and with the microwave amateur make this SMA connector very versatile indeed.

BEST OF MFJ

MFJ, Bencher and Curtis team up to bring you America's most popular keyer in a compact package for smooth easy CW

MFJ-422B **$129.95**

The best of all CW worlds - a deluxe MFJ Keyer using a Curtis 8044ABM chip in a compact package that fits right on the Bencher iambic paddle!

This MFJ Keyer is small in size but big in features. You get iambic keying, adjustable weight and tone and front panel volume and speed controls (8-50 WPM), dot-dash memories, speaker, sidetone and push button selection of automatic or semi-automatic/ tune modes. It's also totally RF proof and has ultra-reliable solid state outputs that key both tube and solid state rigs. Use 9 V battery or 110 VAC with MFJ-1305, $9.95.

The keyer mounts on a Bencher paddle to form a small (4 1/8 x 2 5/8 x 5½ inches) attractive combination that is a pleasure to look at and use.

America's favorite paddle, the Bench, has adjustable gold-plated silver contacts, lucite paddles, chrome plated brass, and a heavy steel base with non-skid feet.

You can buy just the keyer assembly, MFJ-422BX, for only $79.95 to mount on **your** Bencher paddle.

Artificial RF Ground

MFJ-931 **$79.95**

You can create an artificial RF ground and eliminate RF "bites", feedback, TVI and RFI when you let the MFJ-931 resonate a random length of wire and turn it into a tuned counter-poise. MFJ-931 also lets you electrically **place a far away RF ground directly at your rig** - no matter how far away it is -by tuning out the reactance of your ground connection wire. 7½x3½x7 in.

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MFJ-204B **$79.95**

Now you can quickly optimize your antenna for peak performance with this portable, totally self-contained antenna bridge.

No other equipment needed - take it to your antenna site. Determine if your antenna is too long or too short, measure its resonant frequency and antenna resistance to 500 ohms. It's the easiest, most convenient way to determine antenna performance. Built-in resistance bridge, null meter, tunable oscillator-driver (1.8-30 MHz). Use 9 V battery or 110 VAC with AC adapter, $9.95.

Super Active Antenna

'World Radio TV Handbook' says MFJ-1024 is "a first rate easy-to-operate active antenna ... quiet ... excellent dynamic range ... good gain ... very low noise factor... broad frequency coverage ... excellent choice."

Mount it outdoors away from electrical noise for maximum signal, minimum noise. MFJ-1024 covers 50 KHz to 30 MHz

Receives strong, clear signals from all over the world. 20 dB attenuator, gain control. ON LED Switch two receivers and aux. or active antenna. 6x23x5 in. Remote unit has 54 inch whip, 50 ft. coax and connector. 3x2x4 in. 12 VDC or 110 VAC with MFJ-1312, $9.95.

MFJ-1024 **$129.95**

MFJ Coax Antenna Switches

$34.95 MFJ-1701

$21.95 MFJ-1702

New

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Select any of several antennas from your operating desk with these MFJ Coax Switches. They feature mounting holes and automatic grounding of unused terminals. They come with MFJ's one year **unconditional** guarantee. **MFJ-1701, $34.95.** Six position antenna switch. SO-239 connectors. 50-75 ohm loads. 2 KW PEP, 1 KW CW. Black aluminum 10x3x1½ inch cabinet. **MFJ-1702, $21.95.** 2 positions. Cavity construction. 2.5 KW PEP, 1 KW CW. Insertion loss below .2 dB. 50 dB isolation at 450 MHz. 50 ohm. 3x2x2 in. **MFJ-1704, $59.95.** 4 position Cavity Switch with Lightening/Surge protection device. Center Ground position. 2.5 KW PEP, 1 KW CW. Extremely low SWR. Isolation better than 50 dB 500 MHz. Negligible loss. 50 ohm. 6¼x4¼x1¼ in.

"Dry" Dummy Loads for HF/VHF/UHF

MFJ-260 **$28.95**

MFJ-262 **$69.95**

New

MFJ-264 **$109.95**

MFJ has a full line of dummy loads to suit your needs. Use a dummy load for tuning to reduce needless (and illegal) QRM and save your finals. **MFJ-260, $28.95.** Air cooled, non-inductive 50 ohm resistor. SO-239 connector. Handles 300 watts. Run full load for 30 seconds, derating curve to 5 minutes. SWR less than 1.3:1 to 30 MHz, 1.5:1 30-60 MHz. 2½x2½x7 in. **MFJ-262,$69.95.** Handles 1 KW. SWR less than 1.5:1 to 30 MHz. 3x3x13 in. **MFJ-264, $109.95.** Versatile UHF/VHF/HF 1.5 KW Dry Dummy Load. An MFJ first. Gives you low SWR to 650 MHz, usable to 750 MHz. You can run 100 watts for 10 minutes, 1500 watts for 10 seconds. SWR is 1.1:1 to 30 MHz, below 1.3:1 to 650 MHz. 3x3x7 inches. SO-239 connector

MFJ-1286 Gray Line DX Advantage

New **$29.95** MFJ-1286

Snag rare DX for only $29.95! The MFJ-1286 is a computerized DXing tool that predicts DX propagation. Even the casual DXer can work rare DX by knowing when conditions are best for DX. The Gray Line is the day/night divider line where the most amazing DX happens every day. Now you'll know **exactly** when to take advantage of it.

Gives detailed world map. Shows Gray Line for any date/time, UTC in 24 user chosen QTHs, time zones and more. IBM compatible. Any graphics.

MFJ's Speaker/Mics

For Kenwood, Icom, Yaesu, Santec

MFJ-284 or MFJ-286 **$24.95**

MFJ's compact Speaker/Mics let you carry your HT on your belt and never have to remove it to monitor calls or talk.

You get a wide range speaker and first-rate electret mic element for superb audio on **both** transmit and receive.

Earphone jack, handy lapel/pocket clip, PTT, lightweight retractable cord. Gray. One year **unconditional** guarantee.

MFJ-284 fits Icom, Yaesu. Santec. **MFJ-286** fits Kenwood.

12/24 Hour LCD Clocks

$19.95 MFJ-108B **$9.95** MFJ-107B

Huge 5/8 inch bold LCD digits let you see the correct time from anywhere in your shack. Choose from the dual clock that has separate UTC/local time display or the single 24 hour ham clock.

Mounted in a brushed aluminum frame. Easy to set. The world's most popular ham clocks for accurate logs. MFJ-108B 4½x1x2; MFJ-107B 2¼x1x2

Lighted Cross/Needle SWR/Wattmeter

MFJ-815 **$69.95**

MFJ Cross-Needle SWR/ Wattmeter shows you SWR, forward and reflected power in 3 ranges (20/200/ 2000 watts forward/5/50/500 reflected). Push button range selection. 1.8-30 MHz.

Mechanical zero adjust for movement. SO-239 connectors. Light requires 12 VDC or 110 VAC with MFJ-1312, $9.95.

Deluxe Code Practice Oscillator

New

MFJ-557 **$24.95**

MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base so it stays put on your table. Also portable because it runs on a 9 volt battery (not included) or an AC adapter ($9.95) that plugs into the side.

Earphone jack for private practice. Tone and volume controls for a wide range of sound. Speaker. The key has adjustable contacts and can be hooked to your transmitter. Sturdy. 8½x2¼x3¾ in. One year **unconditional** guarantee

MFJ AC Voltage Monitor

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Prevent damage to rig, computer or other gear. Monitor AC line voltage for potentially damaging surge/ brown out conditions on 2-color expanded 95-135 volt scale.

Plugs into any AC outlet. 2% accuracy. 2¼x2¼x1½ inches.

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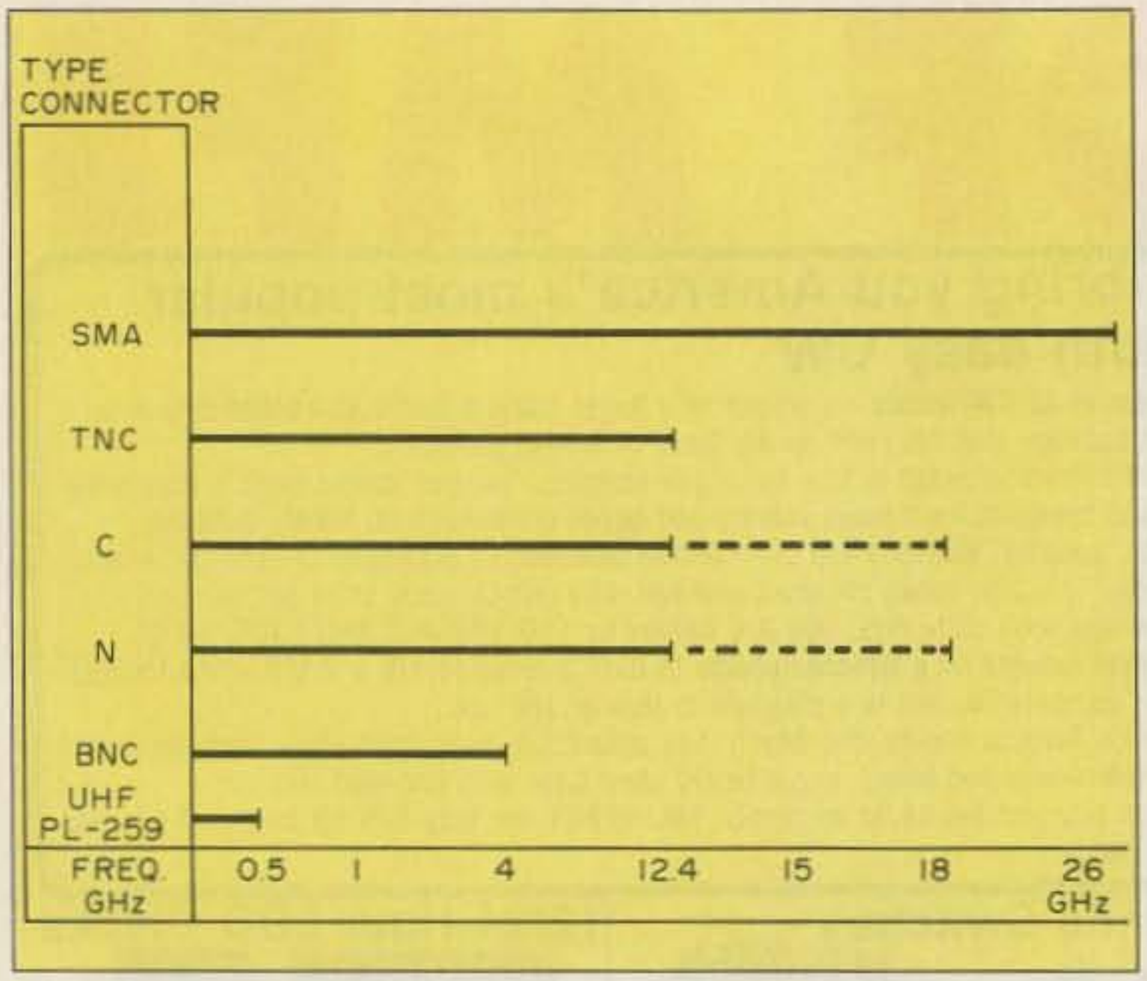

Figure 2. Bargraph of effective frequency limits for popular connectors.

Coaxial Cables

The "Coaxial Cable Loss: Quality Comparisons" table shows the commonly used coaxial cables and provides some loss figures comparing the various types. These coaxial cables are what is normally stocked at amateur retailer stores. For the microwave frequencies, the cables used are mostly a variety of the RG-8U types. I have used several pieces of RG-9BU, which is very similar to RG-8, except that it is a double-shielded braid. This makes it more difficult to assemble the connectors, but the effort is worth it. The double shield allows less leakage than its single-braided counterparts. I did not find RG-9 available from retailers so I did not list it. RG-213 is useful at frequencies up to 10 GHz in short lengths to connect test equipment together. I think most of us have obtained similar cables in microwave test sets from surplus deals.

At frequencies above 1 GHz you should try to minimize feedline loss. One method to lower feedline loss is to mount the equipment near the antenna so that the IF signals at a lower frequency will be cabled to the operating position, allowing you to locate the microwave transmitter and receiver at the antenna.

This is by no means a complete list of cables and connectors—the list was prepared to give you some idea of what is available. As you can see, the loss factors in comparison to the #318 Heliax™ cable look dismal at best. The cost is high, but it's well worth it. That's why most commercial installations use Heliax for the very low loss. Remember that three dB of loss means that one-half of your power into the cable is absorbed by the cable. That means that if you select RG-174 and use a 100-foot length at 30 MHz, you will have a 6 dB loss with a transmitter that has 50 Watts output. The antenna will receive 12.5 Watts on the other end of the coax.

That's just one reason why 9913 costs 50¢ more a foot than RG-174. The 9913 is a poor man's Heliax cable, and cost versus performance is very good. The 9913 is a very good cable. It will never be equal to a true Heliax cable like 318, but the price difference makes up for that.

Beware of bargain priced cables and connectors. Many of these "No Name" connectors are junk! They don't solder well, and the center insulation of the PL-259 melts when you solder the braid. You can recognize them by the very shiny, almost plastic, finish and by the "No Name" printed on them. The good ones are all stamped with identifying companies' names and types.

Even if price is your only objective, consider that most amateurs keep a feedline and antenna system ten years or more, Spend a little extra and your connectors and feedline won't let you down!

Hodgepodge

The Ventura Amateur Radio Club was presented with a 50-year affiliation certificate from ARRL section manager Tom Geiger. Congratulations for 50 years of club activity! The club is presently putting together plans for a group 10 GHz construction project.

The *QST* "New Frontier" column in March 1989 described two 10 GHz Gunn oscillators connected through a "Magic T" to lock the two oscillators to each other, providing more output than the two oscillators combined normally do. I tried it, and my spectrum analyzer display went nuts. I tried this after Kent WA5VJB stated that he'd had the same result. The oscillators locked over a very narrow adjustment, but did not obtain the higher power output. On a spectrum analyzer, the output looked very dirty. Is there anyone that has made this work? Possibly Kent and I have done something wrong. All this in the pursuit of 10 GHz power!

The North Texas Microwave Society is hosting the 1989 Microwave conference. Ever since its conception in 1985 by Don Hilliard W0PW, it has been held in the Estes Park, Colorado area. Don is taking a break and has allowed the North Texas Microwave Group to move the conference south for a year. This year the conference will be held at the Flagship Inn in Arlington, Texas, October 5, 6, 7 and 8th. October 9th is Columbus Day and may be a holiday for some of you. The location is very near the site where the 1987 Central States VHF Society Conference was held. The ARRL has again agreed to publish the proceedings.

The Flagship Inn is located half way between Dallas and Ft. Worth, minutes away from the DFW airport, and very near "Six Flags Over Texas." Room rates are $50 per night, and a block of rooms has been reserved. Technical sessions will take place both Friday and Saturday. There will be swapfests, noise figure contests, and a surplus tour of the area. These are only part of the events planned in addition to the series of technical sessions. Contact Al Ward WB5LUA at (214) 542-6817, or Wes Atchison WA5TKU at (817) 482-3914 for information. 73

Coaxial Cable Loss: Quality Comparisons

TYPE RG#	8U	8X	58A	59B	174	213	214	9913	318	½	½
OHMS	52	C52	52	75	50	50	50	52	50	50	75
DIA IN.	0.405	0.305	0.405	0.242	0.100	0.405	0.405		1.25	0.6	0.63
MAX KV.	4	4	5	2.3	1.5	5	5	3	10	5	5
LOSS dB/100 FT.											
30MHz	0.9	1.3	2.6	2.5	6.0	1.2	1.2	0.5	0.1	0.3	0.4
150 MHz	2.0	3.2	7.0	4.5	NR	3.0	3.0	1.5	0.35	1.0	1.3
450 MHz	3.5	8.0	NR	7.0	NR	5.8	5.8	2.9	0.80	2.0	2.5
1 GHz	6.0		NR	NR	NR	10	10	4.8	1.2	2.5	3.4
5 GHz	NR		NR	NR	NR	NR	NR	NR	3.2		
COST/FT.			0.35	0.14	0.10		1.55				
HRO	0.59	0.39				0.69		0.69			
TEXAS T		0.22				0.36			4.95	0.79	
AES	0.47					0.69		0.64			

NR= Not Recommended

Suppliers:

Ham Radio Outlet
5375 Kearny Villa Rd.
San Diego CA 92123

Texas Towers
1108 Summit Ave. Ste.#4
Plano TX 75074
(214) 442-7306

Amateur Electronic Supply
4828 W. Fond du Lac
Milwaukee WI 53216
(414) 442-4200

Number 26 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free, on a space available basis. Please type or neatly print your request on a full-size sheet of paper. Use upper and lower case letter—not all capitals. Be sure to print numbers carefully. A "1" and "I"; "7" and "T" or "I" and other numbers and letters can be easily misread when they are not printed clearly. "U" and "V" can also be confused. Thank you for your cooperation.

I have two FAX machines I'd like to put to use. They are Qwip model 1000 and model 1200. I need a manual, schematic, paper type, and source. Thanks for any help.

Chuck Pound
207 West Street
Mineral Point WI 53565

I am looking for anyone who has modified a Heath HW-101 in any way. I am especially interested in solid-state substitutes for tubes within the rig. I will pay for any photocopying and mailing costs.

Jack Burris DA2UI/NZ0C
C Co 1/54 Inf
Box 22998
APO NY 09139

I need manual or instructions for the California Computer System model 7470 BCD A/D converter card for the Apple II computer. Will pay copying and mailing charges.

Waldo Orgnero
Box 32 Site 7 SS 1
Calgary AB CANADA T2M 4N3

Wanted: Information on modification of Dentron "Clipperton L" to operate on 10 meters. Thanks.

Larry Sellars KB5EIU
104 Dennis St.
Lake City AR 72437

Need the SERVICEMAN'S Manual, showing BOARD LAYOUTS for Icom IC-22S. Will pay postage and copying costs.

Timothy P. Brown KA8CIZ
2264 Buxton Avenue
Cincinnati OH 45212

Where can I obtain the 4 x 1K RAM chip type HM-3-6504-9 manufactured by Harris and used in the CMOS super keyer in the 1988 ARRL *Handbook*?

Lionel L. Sharp VK4NS
19 Kelso Street
Chermside, Brisbane
Queensland 4032
Australia

ADVERTISERS

73 INTERNATIONAL

edited by C.C.C.

Notes from FN42

Esperanto. *Let's see how bright we all are. We are told that there are four regional representatives for those interested in the International League of Amateur Radio Esperantists, the one for you to contact depending upon where you live. Ready? "**Regionaj reprezentoj: Nordameriko**—W2CIL E. Lindberg, 113 Maple Drive, NY 14026 Bowmansville, Usono; **Sudameriko**—PT2CA E. Alves Silva, Caixo Postal 04–0144, BR–70000 Brasília (DF) Brazilo; **Azio–Pacifico**—JR1ISG K. Nakazima, Simoongatamati 725, 192–01 Hatiôzi-si, Japanujo; **Europo**—DJ4PG H. Welling, Bahnhofstr. 22, 3201 Hoheneggelsen, Germanujo."*

Additionally, there is the Esperanto-DX-Club and its publication, DX-Informilo. *Contact Günter Conrad, Kafkastr. 48/5M, D–8000 München 83, FR Germanujo.*

European Community. The other day we were asked who belonged to the EC—the "United States of Europe," as some have called it—which is due to put 12 nations under one economic roof (among other standardizations in the social field), by the end of 1992. They are, in alphabetic order, Belgium, Britain, Denmark, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, and West Germany. Compared to, say, the United States, the population of the EC will be larger—322 million as against 242 million. As standardization of communications is one part of the planning, we will report such information as comes, relative to that.

At the moment, we have this bulletin: *FLASH!:* There will continue to be at least three *different* kinds of electric plugs used in the EC. A study found it would cost as much as US$80 billion to insist on one type only!

Roundup

Australia. 5Z4BH tells us that a DOC brochure written for foreign hams wishing to operate in Australia recommends they avail themselves of over-the-counter service instead of applying ahead of time. Visiting Sydney, that's what he did, and: "I had my two-meter handy-talky with me and was on the air and immediately made welcome by the 2-meter repeater bunch even before I was out of the DOC building." (See his full report under the Kenya flag, below.)

South Africa. Peter Strauss ZS6ET writes that life is hectic for him. "I will be in Taipei [Taiwan] from June 6th to 25th June, 1989, on business, but also hope to meet again OM Tim Chen. In the meantime I have been appointed as the IARU co-ordinator for South Africa by the 'Interim Management Committee' of SARL."

Reporting in the South African Radio League *Bulletin*, Peter writes: Following the acceptance by a large majority . . . the Headquarters of the South African Radio League [will move] from Cape Town to the PWV area [Johannesburg] . . . *This will bring a lot of SARL HQ activity!—Peter.*

New ZS3UN call suffix now available!: In response to a proposal from the SARL, the licencing authority in Windhoek, SWA/Namibia have introduced a new callsign prefix on application available to radio amateurs in South West Africa who are members of UNTAG. The foreign amateur's home callsign will follow the prefix ZS3UN/ . . .

The United Nations Transitional Assistance Group (UNTAG) consists of a team from Australia, Great Britain and other nations. This group will supervise the transition of the territory to independence in terms of UN resolution 435 and is expected to stay for at least 12 months. Previously licence facilities have been limited to permits valid up to 3 months unless the visitor arrived from a country with which a bilateral agreement had been concluded. Now radio amateurs of the UNTAG group holding a valid CEPT class I or CEPT class II compatible licence may operate while in the ZS3 call area.

Applications should be addressed to: The Postmaster General, (Radio Section), PO Box 287, Windhoek 9000, South West Africa/Namibia.

Two repeaters for 2 metre mobile operation are currently operational and a digipeater is planned for installation during 1989 in the territory. *I know of no other administration to introduce facilities for "visiting" UN forces so quickly! A big Rah Rah Rah to the chaps in the licence authority in Windhoek!—Peter.*

[Remember that the following was written April 2.] Amateur Radio operation from Marion Island will soon be causing pile-ups when ZS8MI becomes active again. The Island was last heard on the air 10 years ago when Johan Jordaan ZS6BEE spent 14 months there. This week Peter Sykora ZS6PT left on the supply ship and is expected to arrive some time today. Within a few days he will be active using the new callsign ZS8MI. Besides HF he will also be operating on 6 metres and on Packet Radio. The QSL address is PO Box 1387, Van der Bijl Park 1900, or to ZS6PT via the SARL QSL bureau. *The old callsign was ZS2MI!—Peter.*

KENYA

Rod Hallen 5Z4BH
Box 55
APO New York 09675

Report from East Africa

This has certainly been an exciting year so far! Just before it

Calendar for July

1—Canada Day; National Day, Burundi and Rwanda (5th for Cape Verde, 6th for Malawi)
4—Philippine American Friendship Day; Independence Day, USA (5th for Venezuela, 9th for Argentina, 10th for Bahamas, 20th for Colombia, 26th for Liberia, 28th for Peru)
12—Orangemans Day, Northern Ireland
14—Bastille Day, France
17—Constitution Day, Korea; National Holiday, Iraq (21st for Belgium)
18—Liberation Day, Nicaragua
19—Martyrs' Day, Burma
22—National Liberation Day, Poland
23—Revolution Anniversary, Egypt
24—Simon Bolivar's Birthday, Latin America
25—St. James Patron Saint, Spain
26—National Rebellion Day, Cuba
31—Revolution Day, Congo

ZS To F Packet Contact

26 Mar 89 06:05:46 Z From: ZS6CE and ZS6SAT—To: ALL and ZS6IT—Subject: FM SIXMETER PACKET FIRST "ZS"!

HI THIS IS ETIENNE, KG 34 RANBURG DISTRICT [NEAR JOHANNESBURG]
ON 25 MARCH 1989, ZS6CE MADE THE FIRST SIXMETER DX FM PACKET CONNECT 1200 BAUD
THE TIME WAS 1732 LOCAL TIME.
THE FREQ 50.400 FM!!!
THE STATION F6FEF JN06 FRANCE.
CONDITIONS WERE FAIRLY GOOD ON SIX!!
THE AVERAGE RETRY WAS 4 WHICH WAS GOOD, BEARING IN MIND THAT IT WAS FM DX ON VHF.
RST SENT 579 RECEIVED WAS 559.
AT 1732 OM ERROL IN KG 33 CONNECTED TO F6FEF. RST GIVEN UNKNOWN RST GIVEN 579. [?]
ZR6KE THEN DIDGI THRU ZS6CE RST RX'D WAS 599 AGN...
ALL CONTACTS WERE SUCCESSFULL.
F6FEF (MIKE) THEN WENT ON TO WORK ZR6KE–1 PBBS AND SUCCESSFULLY LEFT A MSG.
A BEACON WAS ALSO SENT VIA ZS6CE AND WAS HEARD FAIRLY WELL AT ZS6CE QTH.
WELL ANOTHER FIRST FOR ZS PACKET
F6FEF FADED OUT 1h45 MIN AFTER THE 1ST CONNECT.
WELL DONE TO ALL HI..
P.S.
••
F6FEF READ A CQ SENT BY ZS6CE and ZS6SAT
••
73 ETIENNE PACKETNUT ALL MODES DIGI de ZS6ET

began, I became QRV on RTTY with my Compaq Deskpro 286, AEA PK-232, Kenwood TS-430S, and CushCraft A-3. I've been making contacts as fast as I can type, ever since. That is, when I'm here! Starting in mid-January, my XYL and I spent five weeks on R&R in Sydney, Australia, which is her home town.

My VK1HR license had expired a few years ago, and I was hopeful that it was still available and could renew it. I shouldn't have worried: The whole process took less than 20 minutes and cost A$30 (about US$27) for one year.

Now that is true over-the-counter service. In fact, the DOC recommends in a brochure written for foreign hams that they avail themselves of this service instead of applying for an operating permit in advance. I was on the air with my 2-meter handy-talky before leaving the building. They tell me there are 90 2-meter repeaters in VK land.

Before departing Nairobi, I was lucky enough to become acquainted with Pat VK1RZ on the 15-meter Australia—New Zealand—Africa (ANZA) net, which meets every day at 0500Z on 21,205 MHz. Both Pat and John VK2MUV were very gracious hosts during my visit to Australia, providing me with a super station to operate from, and also organizing a Ham Bar-B-Que in my honor. Just before leaving Nairobi I blew the finals in the TS-430S (too much RTTY keydown time!!), so I took it along and had it repaired by Kenwood Australia.

As luck would have it, the Central Coast Amateur Radio Association was having its annual Field Day near Sydney. (In the States, we'd call this a Hamfest with dealer displays, contests, seminars, and a large flea market.) I was told this was the largest Ham gathering in Australia ever, with over 1200 in attendance. I attended a seminar on Packet radio networking which was way over my head, but I'm sure interested. Would you believe I didn't win the prize for traveling the farthest even though I came 8,000 miles!?

I was back home again only long enough to warm up the rig to make sure it was operating properly before I was off again - to Burundi (9U5) and Rwanda (9X5). No activity in the former but I did spend a lot of time in the shack of Jon 9X5AA. He is a CW operator primarily, so I did my part by giving out quite a few hundred SSB contacts on 10 and 15 meters.

Jon and I are planning a DXpedition to 9U5. We haven't set a specific date yet, but it will be either late Spring or Summer, and before Jon leaves Kigali this Fall for a new posting in Capetown. No trouble with a license and we have plenty of equipment, but a big problem will be a good portable antenna. We've even picked out a location on the shore of Lake Tanganyika. The Comoros Islands (D68) looks like a very good possibility for a DXpedition, also.

My biggest dream is to operate from either 9X5, 9U5, or some other exotic East African location on RTTY, but first I'll need a portable computer to travel with. I'm considering the Toshiba T-1000 or the Sharp 4502, but I may have to wait for my home leave next year before I can get one. The AEA PK-232 is a fantastic piece of equipment, especially with the PC-Packrat software, and easy enough to travel with. I will be here for the next two and a half years, and even when Jon leaves Kigali, I hope I will be able to operate 9X5AA from time to time.

I've written a logging program running under dBASE III Plus that makes logging and searching for past contacts immensely easy. I'm modifying it now so that it will automatically give me DXCC, WAS, WPX, and other reports. Once a month I send an up-to-date floppy diskette with my log on it to Bill KE3A, my QSL manager, and he runs it on his computer. I certainly appreciate this! I wouldn't have nearly as much time to operate if I had to spend time slaving over piles of QSLs.

RSK, the Radio Society of Kenya, is still very active. Total membership now stands at 110. The 2-meter repeater is being moved to a better location and a 70-cm repeater is in the works. The club station, 5Z4RS, is being renovated to encourage more members to use it.

If you're interested in the Kenyan Award, ten points are required. Contact with any RSK member counts 2, and with 5Z4RS counts 5. Send a certified list of contacts, a large SAE, and $5 or 5 IRCs (not 10 as stated in the 1987 ARRL Operating Manual) to the RSA, PO Box 45681, Nairobi, Kenya.

Good news: It appears Kenya will have a Novice licensing regulation in effect this year! This should help swell the ranks of 5Z4 amateurs. RSK will be doing its part.

USSR

From Mike F. Shakirov UA9MI
PO Box 2056
Omsk 644119, USSR
via Ken Carpenter KC4UG,
PO Box 586
Vernon, AL 35592

[*Faster than we could say to KC4UG, "maybe he [meaning UA3MI] can send replacements?"—which is what we did say in the May issue—he did! And Ken has passed them on to us. Ken notes that on the back of the amplifier photo it says that it has "equal performance with the Alpha 77D."—CCC*]

Dear Ken—Thanks for your letter and the news from Vernon and USA. I am very sorry that my letter was opened and two pictures missing. I am enclosing duplicates, please send them to *73 Magazine*.

I said hello to [Hambassador] UA9MA and the gang in Omsk for you—no problem. I have only one daughter so far. My age is 41. Ken, your plans to visit the USSR is very good. I also have a dream to visit the USA, but the demands of my jobs will make it very difficult.

Best wishes, dear Ken, to all your family, also to the ham radio gang in Vernon. 73

The UA9MI home-designed and brewed linear amplifier.

The station of UA9MI.

continued from p. 63

point of attachment for the Hustler resonator.

Two Out of Three Isn't Bad

With that done, it was time for a trial. I installed the now 7.5 foot mast on the mast spring mounted atop the ball mount. I attached two lengths of fishing line to the top of the mast to serve as guys. Then I installed a resonator spring atop the mast, followed by a 75 meter resonator.

No doubt about it, it was a tall mobile antenna. Would this contraption resonate on the 75 meter band with more or less the same resonator whip length? Would it make any difference? And third, would it work on any of the other bands?

After all the guesstimating I had done, I must admit that I was somewhat surprised when I put some RF into the extended Hustler and found the point of minimum SWR nearly on the same frequency as it was with the standard Hustler.

Despite that initial success, I had some doubts as to whether the modification would actually result in any noticeable difference in signal strength. Transmitting with constant power into each antenna, both resonated to the same frequency, there was a consistent 2 dB advantage for the longer antenna at a receiving site ¾ mile away. I didn't get the 3 dB I had hoped for, but 2 dB still seemed to be a worthwhile gain.

I then tried the extended mast with a 40 meter resonator in place of the 75 meter unit. It also provided a low SWR with only a slight change in resonator whip length. The gain on 40 meters with the longer antenna was again 2 dB. Down came the 40 meter resonator and up went the one for 20 meters. After shortening the resonator whip length approximately 2 inches, the 11-foot antenna was ready for action on the 14 MHz band. Gain was again 2 dB.

Increased bandwidth was an additional benefit of the longer antenna. While there was minimal difference between the two antennas on 75 meters, on 40 meters the 2:1 SWR bandwidth increased from 49 kHz to 75 kHz. On 20 meters, it went from 235 kHz to 370 kHz when I changed from the standard Hustler to the extended version.

The final question is: Is it worth it? You have to answer that one. On many transceivers today, 2 dB is typically no more than half an S-unit. Eleven feet of antenna is a lot of mobile antenna for 2 dB. On the other hand, decibels have a tendency to add up, and you should notice a substantial improvement if you change your mobile antenna from a standard Hustler antenna, bumper-mounted, to the extended version mounted as high as you dare on the vehicle. (By my best estimates, an extended version mounted on the bumper would probably be indistinguishable in terms of signal strength from the stock antenna mounted high on the vehicle.)

Also, by changing the length of the extension, and hence the position of the resonator coil, it may be possible to squeeze another dB out of the longer antenna. There is room to experiment in this regard, particularly if you wish to optimize the antenna for one particular band.

GW-BASIC Program News

A BASIC program for estimating antenna gain for VHF/UHF operation appeared in this column in the April 1989 issue. It was written in GW-BASIC for IBM compatibles. Two readers were kind enough to send in their versions of the program, modified for different versions of BASIC. Chuck Bates W6JWX provided a version for the Commodore C-64. Chuck will copy it to your 5-¼" disk if you send it in a re-usable mailer along with a return label and return postage. His address is *Chuck Bates W6JWX, 1637 Lang Avenue, West Covina, California 91790.* Another version, for the TRS-80, CoCo 3, was provided by *Lisle Hines K2QLA, 11 Meadow Drive, Homer, New York 13077.* You may obtain a printed copy of either version of the program by writing me. *(Please enclose an SASE with your request—Ed.)*

One final comment on the VHF/UHF program. I received several letters regarding the original program listing. Unfortunately, several errors appeared in the program after it left my desk. Specifically, they are:

—The at signs ("@") right after the program line numbers in lines 30 and 40. Replace these two with a single space.

—The string " | asteris | ," which appears throughout the program. Change this string to "*".

You may obtain a disk copy of the program by sending a 5-¼" disk with mailer and return postage to the address at the beginning of this column. 73

LETTERS

From the Hamshack

School Package Idea

I've been reading your magazine and editorials for about 10 years with interest. Your ideas about how to get the ham population growing are very good. I agree that we need radio clubs in the schools, but you and I both know that printing editorials has started very few clubs in the years that you've been talking about it.

The biggest help to growth has been that several clubs have set up a Volunteer Examiner program to hold exams before every meeting. We give about four or five exams each month, but almost every person we test JOINS OUR CLUB. Without the organized VE program, we wouldn't be giving exams. The club membership is at its highest level ever, and growing. The VE Program gave us a track to run on.

What is needed to get school radio clubs going is a comprehensive kit. This would cover all aspects of forming and maintaining a club: who to contact in the school, by-laws, meeting formats, meeting ideas, speaker sources, gear donation sources, and success stories. If done well enough, and properly marketed, such a kit could become a national standard, increasing its credibility to school boards.

Someone with access to writing/printing facilities and a known name and access to a national audience could gather these materials and ideas and package them for mass use. I know that this sounds like another dummy who says "you do it, I can't," but you are in a position to put this together. A request in an article or in your editorial for info and ideas from existing clubs should bring ideas and examples. Once put together, it should not be too expensive to print, so if you market it just to cover costs, the price should still be well within anyone's budget. I'll bet a lot of ham clubs would buy the package and that they could find a ham who would be the faculty advisor.

Wayne, I find it hard to believe I'm the first to suggest this. So why has it not been done yet? I think it's a fabulous idea.

Gary R. Lahr N6PBA
Mission Viejo CA 92691

Gary, you're right. If hams who have successfully overcome school bureaucracies and been able to get school radio clubs going will write in, giving details on how they did it, I'll be delighted to gather the material and publish it . . . Wayne

Japanese Licensing Requirements

With half the population of the US, Japan has more than one million hams, or four times as many ham operators. The monthly issues of the largest Japanese ham magazine, *CQ Ham Radio,* is more the size of a telephone book. Japan's ham clubs are full of high school students and enthusiastic newcomers. Why? We can find information on amateur radio licensing in Japan in *Amateur Radio Guide* by Kazuo Niwa JA1AYO.

Japan's Radiotelephone (Fourth Class) license requires radio knowledge at the Japanese junior high school physics level, plus regulations, and allows 10 Watts output on all bands except for 30 and 20 meters and all modes except CW. The Japanese allow a 10 Watt no-code license on most HF bands on the theory that operation at that power level will not cause harmful interference in other countries. In 1986, 1,368,083 Japanese held valid ham licenses. Of these, 1,232,493 held Radiotelephone licenses. Many hams never upgrade from Fourth Class.

The Radiotelegraph (Third Class) license requires a 5 wpm international Morse code test, but it has the same privileges as Radio telephone except that CW is permitted. In 1986, 78,934 people held the Radiotelegraph license.

The Second Class license requires radio knowledge at the high school physics level, plus radio regulations and a 9 wpm code test, but allows 100 Watts output on all bands. Japanese hams holding this license totaled 45,108.

The First Class license requires a junior college physics level of radio knowledge plus regulations, and a 12 wpm code test (see the *ARRL Operating Manual* for the Japanese Morse code). Only 11,548 hams held the First Class license in 1986.

The large Japanese ham population drives a high occupancy of their 430–440 MHz and 1260–1300 MHz bands. The Japanese have no 220 or 902 MHz ham bands. They just have 144–146 MHz at 2 meters.

The Japanese situation is so distinctive that it can only give us a few clues about what no-code licensing might look like in the US. The US no-code proposals I have seen are for operation on the VHF/UHF bands with an examination at about the level of the Technician or General in difficulty.

For the sake of a simple licensing structure and the convenience of the volunteer examiners, I believe the no-code license examination should be the technician examination minus the code test. Let's give the no-code licensees some limited access to 2 meters. Contact with higher class licensees on 2 meters will socialize them into good ham citizens and enable them to meet many other hams. Let's welcome them as full-fledged hams.

David Cowhig WA1LBP
Alexandria VA

DX-ing, contests, pile-ups, traffic handling. When you need to command attention, you will with the SB-1000 Linear Amplifier from Heath. And you'll do it for a cost that no one else can match.

From our recent DX-pedition to Taiwan, operators easily controlled pileups with the SB-1000 and nothing more than a dipole antenna. This means that when conditions are tough, you know you can depend on your SB-1000 to lift your signal above the rest. Whether you're using a dipole or stacked monoband beams.

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We don't play games by using old rating methods to make you pay for input power you don't get at the antenna. What you do get is 1000 watt output of peak envelope power on SSB and 850 watts on CW. Even 500 watt output on RTTY.

On the chance that someone might doubt our claims, at hamfests we demonstrate that with only 80 to 100 watts of drive, our SB-1000 develops more output than even the world-famous Heath SB-220!

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Because you build the Heathkit SB-1000 Linear Amplifier yourself, you not only enjoy cost savings, you have the unique opportunity of knowing your equipment inside and out.

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NEW PRODUCTS

Compiled by Linda Reneau

PRODUCT OF THE MONTH

VideOsmith's SPECTRUM PROBE

The Spectrum Probe lets you design and repair electronic equipment faster and better. This probe causes a standard scope to display logarithmic amplitude vertical versus frequency horizontal. The frequency domain presentation, together with a large visible dynamic range of amplitude, provides a picture of circuit operation which has only been available with equipment costing much more, such as a laboratory spectrum analyzer. The laboratory spectrum analyzer is more flexible, but its input impedance is usually 50Ω. This is fine for VHF, but it would heavily load most circuits.

This Spectrum Probe has an input isolation capacitor of 10 pF, comparable to most scope low-capacity probes, to minimize loading of the circuit being probed. An adapter, supplied, allows you to calibrate and operate in a 50/75Ω coaxial system. The scope processes only a video signal. You can observe 100 MHz carriers through the Spectrum Probe with a 1 MHz scope. Price, $380. *VideOsmith, 1324 Harris Rd., Dresher PA 19025. (215) 643–6340.* Circle Reader Service No. 201.

ORION BUSINESS INTERNATIONAL, INC.

The new Orion OR-2300 antenna rotator, with worm gear drive, is rated at 35 square feet. Compact design allows crank-up and stacked-tower mounting. The large control box has easy-to-read direction indicator with variable speed.

The OR-2300 accepts mast diameters from 1¾ to 3⅛ inches. Flex-mount clamping corrects for misaligned masts and absorbs windload. Built-in thrust-bearing and double bronze bearing decreases friction and load transfer to gear set. Available through dealers. Suggested retail price, $895. *Orion Business International, Inc., PO Box 9577, Canoga Park CA 91309. (818) 888-4927. FAX: (818) 888-5112. Telex: 697-4899. ORION HT.* Circle Reader Service Number 202.

AVCOM

AVCOM'S portable test receiver, the PTR-25, is a battery operated satellite receiver. Its circuitry is derived from AVCOM's COM-2 and COM-3R satellite receivers. The built-in B & W TV offers reduced power consumption and longer battery life than comparable color units. A full range of outputs are available for large TV monitors, video recorders, and audio amplifiers. A special IF sampled output is available for observing the 70 MHz IF signal, including any terrestrial interference, on AVCOM's spectrum analyzers.

The signal strength meter on the front panel is large and easy to read. For dish peaking, the PTR-25 has an audible signal strength indicator. Other features include an internal AC supply, polarotor and polarizer controls, and fast recharge capability. For specifications, contact AVCOM. Price, $1525. *AVCOM, 500 Southlake Boulevard, Richmond VA 23236. (804) 794–2500. Telex: 701-545. FAX: (804) 794–8284.* Circle Reader Service Number 203.

ELECTRON PROCESSING, INC.

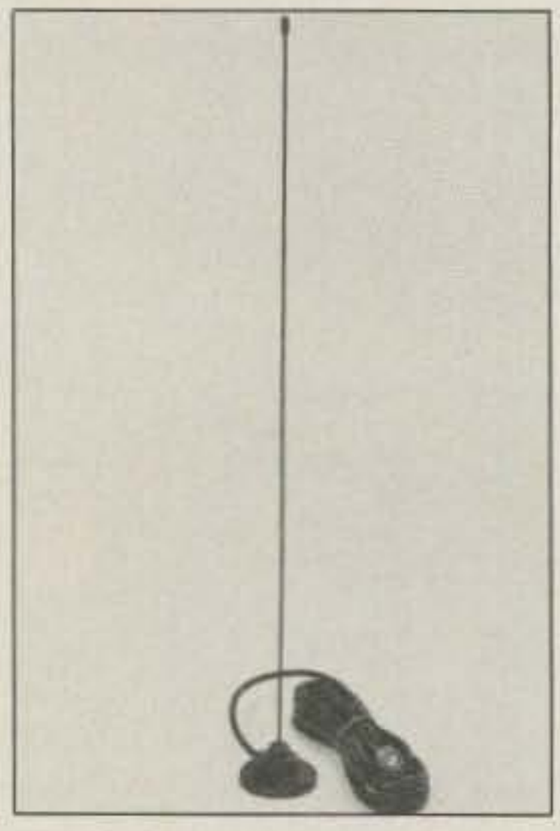
In the field, the IRON SLEEVE™ lets you put your hot soldering iron back in your toolkit without having to wait for it to cool. That's a time savings of from five to ten minutes per service call. The IRON SLEEVE also protects the iron from tip damage.

The IRON SLEEVE is a tube 11" long and 1.5" in diameter. It contains a proprietary heat absorbing mass. Most soldering irons of 50 Watts or less fit the IRON SLEEVE. It's held in place by a hook-loop strap. Prices start at $20, with quantity discounts available. *Sales Department, Electron Processing, Inc., (516) 764–9798. PO Box 708, Medford NY 11763.* Circle Reader Service Number 207.

VALOR ENTERPRISES, INC.

Valor Enterprises's Model PAQM "communications extender" mobile VHF antenna provides mini quarter-wave reception. You can easily install this 2 meter unit with the two-inch magnetic mount, 12-foot cable, and BNC connector, that come with it.

You can modify the unit for operation on 220 or 450 MHz. Price, $14.45. *Valor Enterprises, Inc., 185 W. Hamilton Street, West Milton OH 45383. (513) 698–4194.* Circle Reader Service Number 205.



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Keyword Index

Issue #345

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SPECIAL EVENTS

Ham Doings Around the World

GRAND JUNCTION CO
JULY 1

The Western Colorado Amateur Radio Club, Inc., will hold its Hamfest at the Colorado National Guard armory. Tables, $5; admission, $2. VE testing. *Randy Martens NTØN, PO Box 3422, Grand Junction CO 81502. (303) 242–4205.*

WILKES-BARRE PA
JULY 2

The Murgas ARC will hold its hamfest at the Ice-A-Rama Sports Complex. Free parking, VE exams, electronic show, prizes, 110 V power, outdoor flea market ($3 per space), admission $3. Indoor table, $9. Talk-in on 53.61, 53.81, 146.52, 146.61, 444.825. *Mike Benish K3SAE, Box 214, Rd #1, Pittston PA 18643. (717) 338–6863.*

HARRISBURG PA
JULY 4

The Harrisburg RAC is having a Firecracker Hamfest at the Bressler Picnic Grounds. Admission, $3. Tailgating, $2. Tables, $5 in advance or $6 at site. Talk-in on 147.30/.90 or 52/52. Contact *Dave Dormer KC3MG, (717) 939–4957.*

INTERNATIONAL BOUNDARY
JULY 7–9

The International Ham Fest will be at Peace Garden, on the international boundary 14 miles north of Dunseith, North Dakota, on Highway 281. Camping facilities, primitive and modern, flea market, VE exams, special event station, Saturday night dance, ham and nonham activities. Contact *Tom Williams WDØATI, 612 S. 11th St., Bismarck ND 58504. (701) 258–1947.*

S. MILWAUKEE WI
JULY 8

The S. Milwaukee ARC will hold its 19th annual SWAPFEST at the American Legion Post #434. Parking, picnic area, free overnight camping. Admission $4, including a "happy time" with free beverages. Prizes, exams. Talk-in on 146.580 MHz FM simplex. *The South Milwaukee Amateur Radio Club, PO Box 102, South Milwaukee WI 53172-0102.*

HOBBS NM
JULY 8

KD5RZ will operate the 1st Annual National Royal Ranger Special Event (NRRSE) from 1300 to 0100 UTC, sponsored by the New Mexico Dist. Royal Rangers, a young boys Christian Scouting Organization (ages 12–18), Dept. of Assemblies of God. All amateur operators are invited to help their local Royal Ranger Outposts. Suggested frequencies: 3.870, 7.250, 14.250, 21.320, and 28.520/28.380. For certificate, send QSL and large SASE to *KD5RZ(NRRSE), 1420 N. Tasker, Hobbs NM 88240.*

ATLANTA GA
JULY 8–9

The Atlanta HamFestival will be at the new Georgia International Convention and Trade Center near the Atlanta Airport. Free parking, reasonable motels. *The Atlanta Radio Club, Inc., PO Box 77171, Atlanta GA 30357.*

MAPLE RIDGE B.C.
JULY 8–9

The Maple Ridge Hamfest will be at St. Patricks Center. Prizes, commercial displays, flea market, food, close to shopping and recreation center, camper space, no hookups. Talk-in frequencies: 146.20/.80, 146.34/.94. *Bob Houghton VE7BZH, Box 292, Maple Ridge B.C. CANADA V2X 7G2.*

INDIANAPOLIS IN
JULY 8–9

The 19th annual ARRL Division Convention and Hamfest will be at the Marion County Fairgrounds. New equipment dealers, computer and software dealers. Electronic fleamarket, technical forums, awards, nonham activities. Free hookup and camping. Motels close by. $6 at gate, children under 12 free. Indoor flea market, air-conditioned commercial building. Six large buildings. *Indianapolis Hamfest Association, PO Box 11776, Indianapolis IN 46201. (317) 356–4451.*

CHEYENNE WY
JULY 8–9

The SHY-WY ARC will host the "Wyoming Hamfest" at the Hiliday Inn. Dealer exhibits, indoor swap tables, forums, seminars, and VE exams. Admission, $3 in advance, $4 at door. Talk-in on 146.175/.775 or 146.22/.82. Contact *Fred Dumire N7JPR, PO Box 6262, Cheyenne WY 82003.*

BATAVIA NY
JULY 9

The 9th annual Batavia Hamfest, sponsored by the Genesee Radio Amateurs, will be at the Alexander Firemen's Grounds. Indoor commercial exhibits, spacious flea market, ARRL VEC exams, free camping (electric, $2), breakfast, chicken BBQ, OM/YL programs. Tickets $3 before July 1, $5 at gate. Talk-in on 144.71/145.31 and 146.52. *G.R.AM., PO Box 572, Batavia NY 14020. SASE, please.* For tickets, write *Knute Carlson N2DRX, 26 Burke Dr., Batavia NY 14020.*

LONG ISLAND NY
JULY 9

LIMARC ARRL Long Island Hamfair will be at the New York Institute of Technology. Tailgating, no reservations needed, sellers car space, $5; general admission, $3. Nonham women and children free. Talk-in on 146.25/.85. Awards. Call *Mark Nadel NK2T, (516) 796–2366 or Hank Wener, (201) 694–1811.*

PITTSBURGH PA
JULY 9

The North Hills Amateur Radio Club announces its 4th annual Hamfest. It will be held at the Northland Public Library. Free admission, free dealer and tailgating space, free parking. VEC testing, ARRL table, prize drawings, handicap facilities. For VEC information, send SASE to *John Rosenwald NM3P, 400 Stevens Drive, Pittsburgh PA 15237. (412) 931–2651.* Preregistration suggested. For Hamfest information, send SASE to *Bob Ferrey, Jr., N3DOK, 9821 Presidential Drive, Allison Park PA 15101. (412) 367–2393.*

CATALINA ISLAND CA
JULY 9

Amateur radio station WA6OPZ will operate from 1500 to 0700 UTC from Emerald Bay, Catalina Island, to commemorate the Boy Scouts' use of this bay since 1925. Frequencies: around 28.45 SSB, and the lower 25 kHz of the 15, 20, and 40 meter General phone bands. CW operation will be around 7125 and 21150 kHz. For certificate, send QSL and 9x12 SASE to *Marshall Jacobson, 16441 Gilmore St., Van Nuys CA 91406.*

DOWNERS GROVE IL
JULY 9

The DuPage ARC will have its Hamfest-Computer Show at the American Legion Grounds. Indoor tables, outdoor Swapper's Row, free parking, handicap facilities. ARRL approved, VE license testing (bring a copy of your license). Tickets, $2; $3 at gate. Tables, $10; after June 10, $12. Talk-in on 145.25–600. *Hamfest Chairman, DuPage ARC, PO Box 71, Clarendon Hills IL 60514. Ed (312) 985–0527; Jim (312) 964–5529; Everett (312) 495–1253.*

UNION ME
JULY 15

The second annual Union Hamfest, sponsored by the Maine Hamfest Association, with be at the Union Fairgrounds. Packet radio, technical programs, paved sales and tailgating area, meetings for nets and clubs, and exams. Camping, breakfast, supper. Admission, $2. Tailgating and non-reserved sales space, $1. Talk-in on 146.22/.82 and 146.28/.88. *Maud N1EBC or John Peterson N1CBA, Box 601, Augusta ME 04330. (207) 445–2977.*

AUGUSTA NJ
JULY 16

The Sussex County ARC will sponsor SCARC '89 at the Sussex County Fairgrounds. Registration, $3. Indoor tables, $7. Tailgate space, $5. Free parking. *Don Stickle K2OX, Weldon Rd., RD 4, Lake Hopatcong NJ 07849. (201) 663–0677.*

WASHINGTON MO
JULY 16

The Zero-Beaters ARC will hold its 27th annual Hamfest at Bernie H. Hillerman Park at the Washington Fairgrounds. Flea market ($2 per space), FCC exams (bring photocopy and original license), seminars, dealer displays, nonham displays. Admission and parking free. Talk-in on 147.84/.24 and 146.52 simplex. *Al Lanwermeyer WBØQBS, 909 Nora St., Washington MO 63090. (314) 239–2072.*

WOODLAND PARK CO
JULY 22–23

The Mountain Amateur Radio Club will hold its Annual Swapfest/Campout in the Pike National Forest. Free parking, dealers, swap 'n shop, get-togethers. Advance reservations required for overnight camping. Sellers and overnight campers, $5 per space per day. Talk-in on MARC repeaters 145.16 and 448.65. *MARC, Box 1016, Woodland Park CO 80866. Joe Tafoya NØCMD, (719) 687–3641.*

GLENWOOD SPRINGS CO
JULY 29

The Ski Country Amateur Radio Club Hamfest will be at the Colorado Mountain College Community Education Center. Swap tables, VE exams, free admission. *SCARC, PO Box 302, Carbondale CO 81623. (303) 945–9342.*

ISHPEMING MI
JULY 29–30

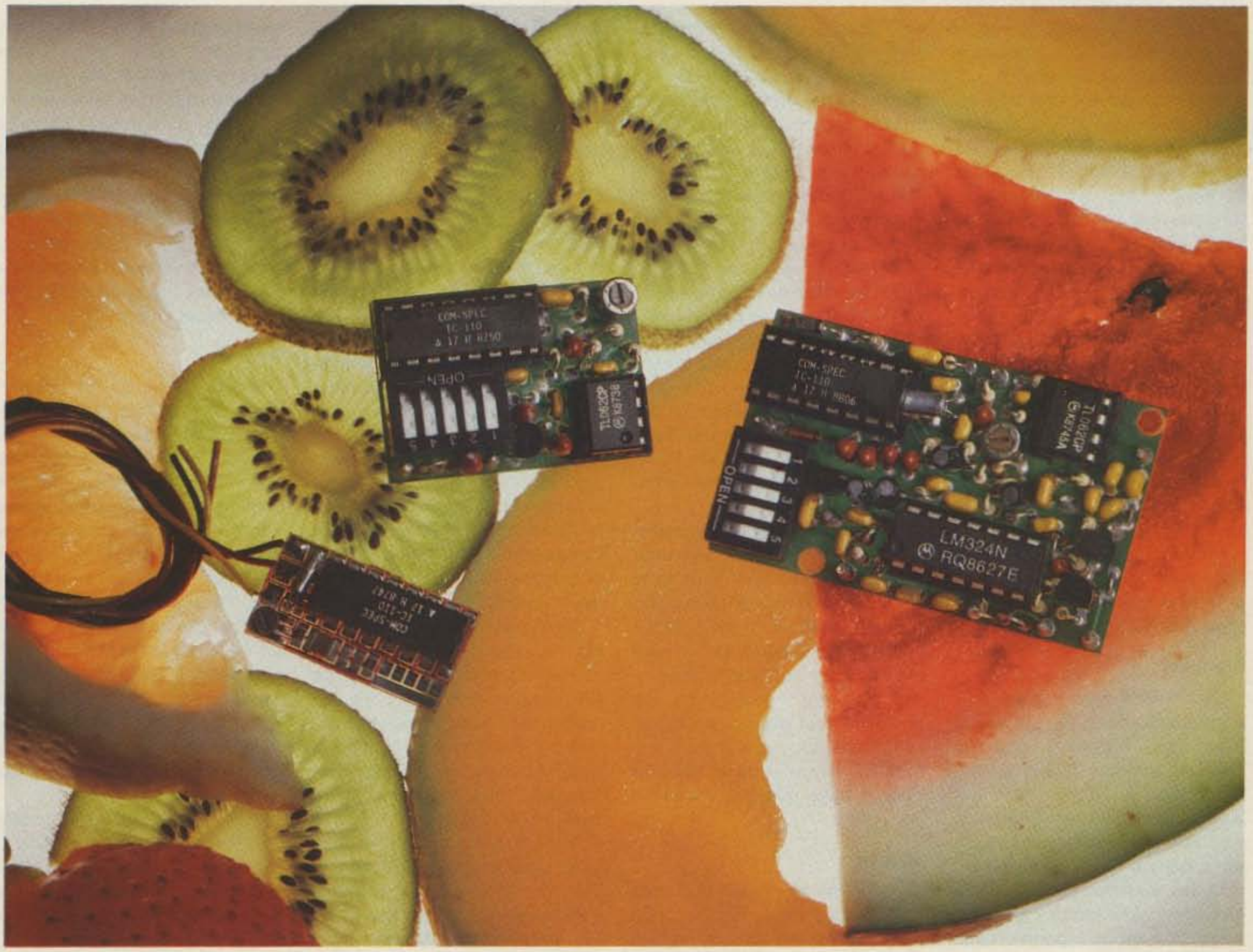
The Hiawatha ARA will sponsor their Upper Peninsula Ham Fest this year at the Marquette Lake View Arena. Large indoor display area, prizes, plenty of parking. *George Uuro N8HVT, Secretary, Hiawatha Amateur Radio Association, Rt. 2, 100 North Daisy, Ishpeming MI 49849.*

BALTIMORE MD
JULY 30

The BRATS Maryland Hamfest will be at the State Fairgrounds in Timonium this year. 8-foot tables are $35 each or 3 for $100, in the Main Exhibit Hall. Fleamarket tables, $20 each. Tailgating space, $5 per vehicle. Admission, $5 per adult, children under 12 free. Free VE exams. Talk-in on 146.16/.76, 147.63/.03, 146.52. *BRATS, PO Box 5915, Baltimore MD 21208.*

PEOTONE IL
JULY 30

Hamfesters Radio Club announces its 55th annual hamfest at the Will County Fairgrounds. Air-conditioned dealer displays, large outdoor flea market, FCC exams. Talk-in frequencies are 146.52 simplex and 146.76/.16 CFMC repeater. *Don Burch N9DWI, 8438 S. Kolin Avenue, Chicago IL 60652. (312) 582–9776.*



Choice Selection.

Now you can have it all! Take all the qualities you've come to depend on in our programmable CTCSS tone equipment: Astonishing Accuracy, Instant Programming, Unequaled Reliability; and add full spectrum tone versatility, multi-tone capability without diodes, a reprogrammable memory...It's our new harvest of CTCSS tone equipment.

The choice is yours! If standard CTCSS EIA tones do not suit your taste, select any 32 tones of your liking from 15.0Hz to 255.0Hz. And if you change your mind, no problem; the memory can be changed in your shop with our HHP-1 programmer, or at our factory for free. Your working tone is accessed by a simple DIP switch, so there's no fussing with counters or other test equipment.

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CIRCLE 10 ON READER SERVICE CARD

able to get some nice testimonials. At $10 a page it isn't like it's a major advertising investment.

Run your advertising department professionally. It's okay to press members into service as ad sales representatives. Hand out the assignments at meetings. Be sure you get an okay for the ad from the advertiser before you run it. You're probably going to have to set the type yourself. If there's a photo you can charge the advertiser for the cost of the halftone, but not for the typesetting. Be sure every advertiser has okayed his ad and knows it is going to run. They can get awfully mad if you run an ad without permission one month and then bill them for it. That's one way to lose a customer, and his friends.

Another source of income is from small ads by club members with used ham gear (or anything else) for sale, or wanted.

Printing

If you have a small club and only need a hundred copies you might make a deal with someone in the club with a photocopier to buy the paper and run off the pages that way. All you have to do is come up with the copy-ready pages with the computer. This, alas, will limit your use of photos severely. Photocopiers make mud of pictures, so you'll want to depend on line drawings. If you have an artist or cartoonist in the club you're all set.

It costs a bit more, but with quick-printers everywhere, not much more, if you go photo offset. Then you'll be in great shape to include pictures. For a little extra you can even go to two colors—if your printer has a two-color press. If he doesn't, you're looking at a higher cost when he has to clean the black ink off the rollers, re-ink them with red and run the paper through the press a second time.

Most printers have offset presses that will handle 11" x 17" sheets. This will allow you to print eight pages on one sheet of paper if you make your page size 5½" x 8", which is pretty standard. It's easier to see on the Mac than 8½" x 11", too. Thus, two press sheets will give you a 16-page newsletter, allowing about eight pages for ads ($80). The printer should be able to fold and trim the pages for you in eight-page sections, making it simple to insert one in the other and zap in a staple to hold them together.

Printing prices vary somewhat so if you start a club newsletter please let me know your total costs per issue so I can pass along the information to help other clubs. I'm interested, too, in seeing your balance sheet for the project, showing income from ads and all of your expenses. Only in communist countries is there any problem with making a profit, so make it make money for the club if you can.

Mailing

The same Macintosh that does the finished pages for you can print out the self-sticking mailing labels. Try to remember to leave a spot for the label on the cover of the newsletter. If you forget the first month I guarantee you'll remember it from then on.

For postage you can save money by getting a permit and printing the permit number on the newsletter. Check with your postmaster for details. It beats the heck out of licking rolls of stamps.

Be Conservative

The Mac is capable of doing all sorts of amazing things so you're going to have your hands full keeping the editor from showing off a hundred different fonts in each issue. Be firm . . . make him stick to the same type fonts all through the newsletter and not go berserk with Old English, German Script and so on.

Macs make it easy to repeat artwork, so your club artist can come up with some cute drawings that you can put here and there, changing sizes as you wish. A friend of mine who was into computers early on had a thing about dragons (he still does), so he embellished his newsletter (People's Computer Company) with all sorts of dragons—and that was before the Macintosh.

The typesetting programs handle H & J (hyphenating and justification), so don't go avant-garde with ragged right copy: it's too hard to read. Also, I highly recommend the use of a serif style of type for body copy, and sans-serif for titles. You don't know what a serif is? Tsk, look it up.

A good newsletter will keep your club growing and active. There's nothing better to make sure members don't miss a meeting, and to get local hams to break down and join the club. If your club is giving Novice classes the newsletter is a great place to run pictures of the prospective hams and to reward them when they make it. Can you get the newsletter posted on the bulletin board in your local grade and high schools? Have you forgotten to send a copy to your local newspaper editor and radio station?

If your club is on the ball and working hand in hand with local service groups such as the Lions, Kiwanis, Elks, Masons, and so on, you can run articles on your club support activities in your newsletter and see that extra copies are sent to the service club to be distributed at their next meeting.

These service clubs often do community work where communications is helpful. It may be cleanups, walking for dollars, marathons, auctions, car rallies—whatever it is, your club should be able to help with communications. If you have anyone in your club who is good at speaking, have him address these service clubs and explain the value of amateur radio to the community and to the country. With any luck you'll run across some teachers or even school officials—and it's just a step from there to getting kids interested.

If your club does get a newsletter going I'd appreciate being on the mailing list. And if it does as well for your club as newsletters are doing for others, I'd like a note from you I can publish in *73*. It just might get more clubs off dead center. Sometimes it takes a lot to stir up ham clubs which are in the hands of old timers.

Reviews

We are looking for readers who'd like to help out at home. You can let us know how you like any new piece of equipment you buy. With all the great new stuff coming out, you'd expect a flood of reviews. By this printing, some of you will have already some months' operating experience with the new ICOM 725 and 765 HF rigs, or Yaesu's new 1020 HF rig—why not tell us about them? If feedback is any indication, the readers are clamoring to know about them. No, we're not interested as much in a laboratory report as we are in a ham shack/operator's report.

When I'm thinking of buying something new, which is most of the time—a lot of thinking, not so much buying—I want to know what others who've bought it have found. Is it easy to use? Is it fun? Does it do everything the ads say? What do I need to go with it? I want to know how it was for you and how you think I'll like it.

Wouldn't you rather know how other average hams make out with new gear than read a scientific lab report? On a transceiver, how useful are the memory channels? How easy is it to change bands? What kind of signal reports does it bring? Will it control my amplifier all okay? What problems may I run into?

Let's say you've finally made the big move and bought a packet unit. What happened? How has it worked out for you? Are you happy with it or do you wish you'd bought another? How was your first packet QSO? Are you having fun? Would you recommend we all give it a try? Any helpful ideas to make our packet experience more fun?

I'm not going to be satisfied until I'm able to publish reports from users on every new piece of ham gear, from the largest to the smallest. I want to be able to look back in *73* and find out enough about anything I'm interested in to make a buy/no-buy decision. 73

ORR'S ISLAND, MAINE — K1MJP — PETER O. RUSSELL

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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Factory authorized dealer! Yaesu, ICOM, Ten-Tec, KDK, Kenwood, AEA, Kantronics, Santec. Full line of accessories. No sales tax in Delaware. One mile off I-95. **DELAWARE AMATEUR SUPPLY, 71 Meadow Road, New Castle DE 19720; (302) 328-7728.**

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A full service Ham Radio Store! Discount sales and service on most major brands. Monday to Friday 12:00am to 7:00pm, Saturday 10:00am to 4:00pm ¼ mile south of Rt.3. **ABARIS SYSTEMS, 227 Stuyvesant Avenue, Lyndhurst NJ 07071; (201) 391-7887.**

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Your company name and message can contain up to 25 words for as little as $300 yearly (prepaid), or $175 for six months (prepaid). No mention of mail-order business permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '89 issue must be in our hands by February 1st. Mail to *73 Amateur Radio*, Rebecca Niemela, Box 278, Forest Road, Hancock, NH 03449.

Number 30 on your Feedback card

TECH TIPS

Pearls of Tech Wisdom

Cheap Tube Heatshrinking

Heat guns sold for use with heatshrink tubing are quite expensive, costing $100 or more. Other methods, such as hair dryers, electric heaters, propane torches, and soldering irons, have their disadvantages and may even be dangerous. However, there is an inexpensive solution.

Heat gun paint strippers under such brands as Wagner, Black & Decker, and Craftsman have become quite popular in the last year or two. I bought one of these heat guns, but I have yet to remove any paint! It works perfectly for heatshrink tubing. It heats up quickly, and you can easily control the amount of heat by controlling the distance of the gun from the tubing.

These paint stripper guns typically cost $20–30. One brand sold for $15 after rebate. What a bargain!

W.C. Cloninger, Jr. K3OF

Fix for TS-430 Blank Out

Did you ever wonder why the receiver blanks out below 150 kHz on the Kenwood TS-430S? I have!! So, since I love to experiment on my own TS-430S, I went about the task to find out why. It seems that the VCO signal was being switched off by IC1 via Q16 on the PLL Unit (X50-1910-00).

To remedy this, cut R52 (47k ⅛ Watt resistor) located next to Plug 4. I did not measure the sensitivity below 150 kHz, but I was able to receive the Russian woodpecker at 100 kHz at S-5 on my S-meter. Not bad for a receiver not designed to go down that low. (Reprinted from *International Radio and Computers, Inc.*, the IRI Kenwood Newsletter, November/December 1988, Issue 90.)

Craig Fay N7ETV
Las Vegas NV

Better AM on R7000

This simple procedure will narrow the AM selectivity from the factory AM filter preset of ±3.0 kHz at −6 dB. See page 33 of the Owner's Manual for a top view of the RF/IF units.

Remove the receiver's complete top cover. Be careful of the speaker leads which are plugged into the unit. Locate J8 in the IF units. Carefully lift the shorting connector straight up from the factory preset WIDE position and press it down firmly into the NAR position. Replace the top cover and enjoy the receiver's improved AM selectivity. (Reprinted from *International Radio Inc.*, ICOM® Newsletter, April 1988, Issue 84.)

Rene Borde
Monitoring Times

220 AMP TVI

Those who have a Ramsey Electronics PA-20 220 MHz power amplifier (2W in—10W out) may have noticed extensive TVI on channels 11 and 13. The fix is to replace the PIN diode at the transceiver input end of the receive pre amp with a MPN 3401 or similar unit with higher isolation than the original. Problem solved. (Reprinted from *NCARC Communicator*, Vol. 5, Issue 7.)

Bill K1LNJ
KB8CI PBBS

Number 31 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free, on a space available basis. Please type or neatly print your request on a full-sized sheet of paper. Use upper and lower case letters—not all capitals. Be sure to print numbers carefully. A "1" and "I"; "7" and "T" or "I" and other numbers and letters can be easily misread when they are not printed clearly. "U" and "V" can also be confused. Thank you for your cooperation.

After about forty years, I sold my SX-88, and uncovered a considerable interest in the history of this old receiver. Now, much as car enthusiasts have done with cars, I am attempting to locate as many past and present owners as possible of these old receivers. Anyone interested is invited to write.

Also, I have an AZDEN 4000 2 meter rig which needs service, and I can't find out where to send it. Is this outfit still in business?

And finally, I'd like to know if anyone handles parts for the old Hallicrafters.

Bob Forman W9RJH
Monmouth IL 61462-0068

Looking for info to convert the Swan Mark 1 from 3-300Z to 3-500Z tube finals.

Kuby Kubichek
19254 Tranbarger St.
Rowland Hts. CA 91748

Having built the G4ZU (Dick Bird) Super Mimi Beam, I'm interested in results others have had.

A. Kohler W0JHC
842 5th S.E.
Mason City IA 50401

I will pay copying and postage costs for operating manual and schematic, but operating manual primarily for MULT-TECH MODEM model MT212A.

George L. Coleman KA0ZIP
600 South 27th Street #103
Omaha NE 68105

Does anyone have a schematic on a TELCO COUNTER 40, a 40 MHz frequency counter, Model CT-40, MFG. TELCO PROD. CORP. GLEN COVE NY? The corporation is no longer in business. I will pay copy cost.

L.F. Boeckerman
4248 Barth Ln
Kettering OH 45429

Needed: power transformer for an old Heathkit HO-10 Monitor Scope. Thanks.

John R. Somers KC3YB
93-25 Beechwood Place
Crisfield MD 21817

I'm looking for the schematic for the RCA 14T302 CB to convert to 10 meters. Will pay reasonable copying and shipping costs.

Chris Cinalli KA3UGA
819 Stella Ave.
Croydon PA 19020

GET YOUR BEARINGS STRAIGHT

At last! A map dedicated to the radio amateur. Announcing the **Azimuth-Equidistant** wall map from the Great Circle Map Co.

An azimuth map provides information about heading and range to any place on Earth. No longer will you have to guess at which way to aim your beam antenna for that rare DX.

Each map is specially drawn with your station at the exact center. The rest of the world is spread out around you. To use the map, simply find the target station and read the compass heading from the border of the map. To find the range, count the number of rings from the center. Each ring is spaced 1000 miles apart. Voila! You now know the true heading and range to the target station.

The maps are custom drawn with computer accuracy for your location and are personalized with your station's call sign at the lower right. Each map measures 35"x23", is brightly colored, and is printed on high quality poster stock making it suitable for framing.

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PROPAGATION

by Jim Gray W1XU

Jim Gray W1XU
PO Box 1079
Payson AZ 85541

Conditions in July will be spotty. The first ten days of the month will be good to fair for the HF bands. The 11th through the 18th will be poor. The 19th through the 22nd will be good to fair, and the 23rd through the 27th poor to fair, increasing to good for the last four days of the month.

DX in the summer doesn't look good for the HF bands, BUT look on 6 and 2 meters for excellent opportunities during the second and fourth full weeks of the month. On many days, the Earth's magnetic field will be unsettled to active, rising to storm levels around the 4th, 14th, and 25th. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	-	-	-	-	20	20	20	-	-	-	15
ARGENTINA	15	20	20	20	-	-	-	-	-	10	10	10
AUSTRALIA	-	-	-	20	20	20	15	15	15	-	-	-
CANAL ZONE	15	15	20	20	20	-	20	20	15	10	10	10
ENGLAND	20	20	*40	-	-	20	-	15	15	20	20	20
HAWAII	15	15	15	20	20	40	20	-	-	-	15	10
INDIA	15	20	-	-	20	20		-	-	-	-	-
JAPAN	15	-		-	-	20	20	20	-	-	-	15
MEXICO	15	15	20	20	20	-	20	20	15	10	10	10
PHILIPPINES	20	15	20	20	-	-	20	-	-	-	-	-
PUERTO RICO	15	15	20	20	20	-	20	20	15	10	10	10
SOUTH AFRICA	-	-	-	20	20	-	-	15	15	15	20	20
U.S.S.R.	20	20	20	20	-	-	20	-	-	15	15	20
WEST COAST	*15	*15	80	80	80	-	20	20	20	20	15	15

CENTRAL UNITED STATES TO:

ALASKA	-	15	15	-	-	(h) 20	20	20	20	-	-	-
ARGENTINA	15	15	20	20	-	-	-	-	-	10	10	10
AUSTRALIA	15	15	15	20	20	20	20	20	-	-	-	-
CANAL ZONE	15	15	20	20	20	20	20	20	20	15	10	10
ENGLAND	20	20	20	40	-	-	-	-	-	-	-	15
HAWAII	10	15	15	20	(h) 20	(h) 20	20	20	-	-	-	-
INDIA	(a) 20	(a)(h) 20	-	-	-	-	20	-	-	-	-	-
JAPAN	-	15	15	-	-	(h) 20	20	20	20	-	-	-
MEXICO	15	15	20	20	20	20	20	20	20	15	10	10
PHILIPPINES	20	20	15	20	-	-	-	-	-	-	-	(a) 20
PUERTO RICO	15	15	20	20	20	20	20	20	20	15	10	10
SOUTH AFRICA	-	-	40	20	-	-	-	-	15	20	20	-
U.S.S.R.	20	20	20	-	-	-	-	-	-	15	15	20

WESTERN UNITED STATES TO:

ALASKA	15	15	20	20	20	20	(f) 20	20	15	20	-	15
ARGENTINA	10	15	15	20	(h) 20	-	20	20	-	-	-	15
AUSTRALIA	10	10	15	15	20	20	40	40	20	-	-	-
CANAL ZONE	15	15	20	(h) 20	(h) 20	40	80	-	-	(g) 15	(g) 15	15
ENGLAND	15	20	20	20	-	-	-	20	15	15	-	15
HAWAII	15	15	15	20	20	40	40	20	-	-	15	10
INDIA	-	-	15	-	-	-	20	20	20	15	-	-
JAPAN	15	15	-	20	20	20	40	20	20	20	-	15
MEXICO	15	15	20	(h) 20	(h) 20	40	80	-	-	(g) 15	(g) 15	15
PHILIPPINES	-	-	15	-	-	20	20	20	15	15	-	-
PUERTO RICO	15	15	20	(h) 20	(h) 20	40	80	-	-	(g) 15	(g) 15	15
SOUTH AFRICA	-	-	-	20	20	-	-	20	20	15	-	-
U.S.S.R.	20	20	20	20	20	-	-	-	-	-	-	-
EAST COAST			80	80	80	-	20	20	20	20	15	15

JULY

SUN	MON	TUE	WED	THU	FRI	SAT
						1 F–P
2 P	3 P–F	4 F–G	5 G	6 G	7 G	8 G
9 G–F	10 F–P	11 P	12 P	13 P	14 P–F	15 P–F
16 P–F	17 F	18 F	19 F	20 F–G	21 G	22 G–F
23 F–P	24 P	25 P–F	26 F	27 F	28 F–G	29 G
30 G	31 G					

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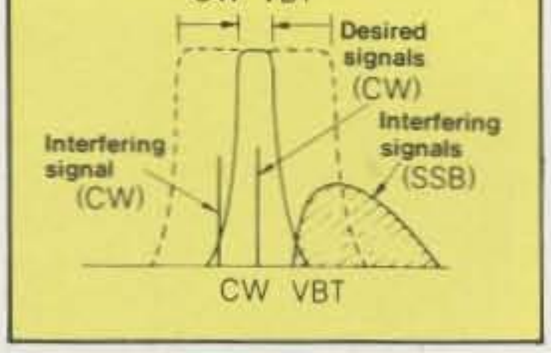

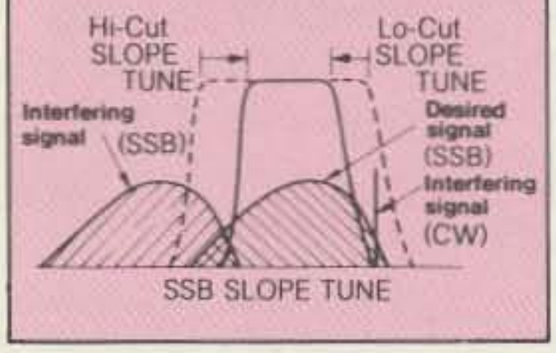

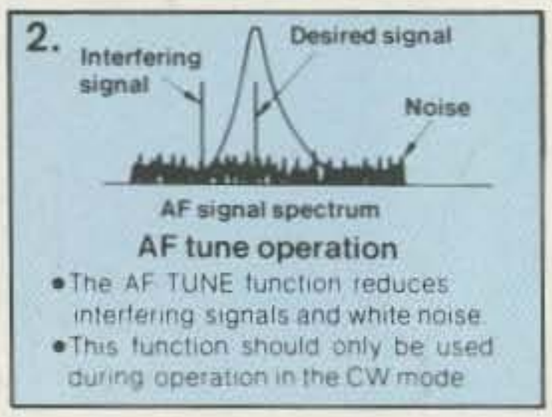

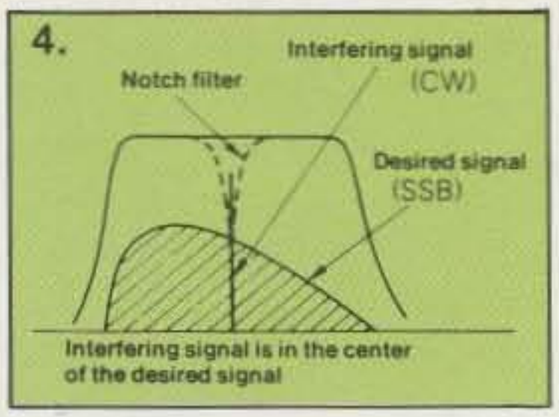

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